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Standardizing the southern Gulf of St. Lawrence bottom trawl survey time series: Results of the 2004-2005 comparative fishing experiments and other recommendations for the analysis of the survey data

Normalisation de la série chronologique des relevés au chalut de fond effectués dans le sud du golfe du Saint-Laurent : résultats d'études de pêche comparatives de 2004-2005 et autres recommandations pour l'analyse des données des relevés

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ABSTRACT

Bottom-trawl surveys have been conducted annually in the southern Gulf of St. Lawrence during the month of September since 1971. These surveys provide a time series of information on the abundance, size-composition and distribution of more than 70 species of marine and diadromous fish and over 40 marine invertebrate taxa. However, most research activities utilizing these data are contingent on the continuity of the time series for each taxon. This means avoiding or correcting for any systematic changes in catchability of the survey, such as might occur when there is a change in sampling gear, research vessel or the time of day in which scientific fishing takes place. The research vessel *CCGS Teleost* replaced the *CCGS Alfred Needler* as the survey vessel for the southern Gulf of St. Lawrence multi-species survey in 2006. The present report contains results from comparative fishing experiments conducted with these vessels that took place in 2004 and 2005. Recommendations for the application of those results, for dealing with issues related to taxonomic identification during the surveys, and for dealing with issues related to survey coverage during the period of 2003-2005 are also included. This report is a follow-up to Benoît and Swain (2003, Can. Tech. Rep. Fish. Aquat. Sci. 2505), which documents the corrections or considerations that should be taken into account when analysing the southern Gulf of St. Lawrence survey data over the period 1971-2002.

RÉSUMÉ

Depuis 1971, des relevés au chalut de fond sont effectués tous les mois de septembre dans le sud du golfe du Saint-Laurent. Ces relevés fournissent une série chronologique d'information sur l'abondance, la répartition géographique et la distribution des tailles de plus de soixante-dix espèces de poissons marins et diadromes ainsi que de plus de quarante taxons d'invertébrés marins. Cependant, la plupart des activités de recherche s'appuyant sur ces donnés dépendent de la continuité des séries chronologiques pour chaque taxon. On doit donc éviter ou corriger tous les cas où la capturabilité d'une espèce par le relevé a changé de façon systématique, notamment lorsqu'il y a un changement de navire ou d'engin de pêche scientifique ou lorsqu'il y a un changement dans les heures durant lesquelles l'échantillonnage a lieu. Le NGCC Teleost a remplacé le NGCC Alfred Needler comme navire de recherche scientifique pour le relevé annuel au chalut de fond effectué dans le sud du golfe du Saint-Laurent en 2006. Le présent document rapporte les résultats d'études de pêche comparatives entre ces deux navires, qui ont eu lieu en 2004 et en 2005. Des recommandations sont aussi présentées pour la mise en application de ces résultats, pour rectifier les problèmes reliés à l'identification taxonomique de certaines espèces lors des relevés et pour résoudre les problèmes reliés à la couverture géographique du relevé en 2003-2005. Le présent document fait suite à celui de Benoît et Swain (2003, Can. Tech. Rep. Fish. Aquat. Sci. 2505), qui contient des corrections ou recommandations à appliquer lors des analyses des donnés du relevé du sud du golfe du Saint-Laurent pour la période 1971-2002.

1. INTRODUCTION

Bottom-trawl surveys have been conducted annually in the southern Gulf of St. Lawrence (NAFO Div. 4T) during the month of September since 1971 (for details see Hurlbut and Clay, 1990). These surveys provide a time series of information on the abundance, size-composition and distribution of over 70 marine and diadromous fish species and over 40 marine invertebrate taxa (Benoît et al., 2003a,b). This information is the cornerstone for the majority of the stock assessments of commercially important marine fishes in the southern Gulf. It is also crucial in assessing the status of many marine fishes as part of Fisheries and Oceans Canada's (DFO) Species-at-Risk mandate (Benoît et al., 2003a; Swain et al., 2006;) and in understanding changes in the structure and function of the ecosystem as a whole. These research activities are contingent upon the continuity of the time series for each species. Survey timing (i.e., season), area sampled, time of day in which fishing takes place, and the research vessel and gear used are all known to affect the availability of organisms to the gear or their catchability (e.g., Benoît and Swain 2003a,b; Pelletier 1998; Nielsen 1994). Any change in catchability resulting from modifications in one or more of these factors could, if unaccounted for, be incorrectly be interpreted as a change in resource abundance.

With the exception of the addition of three inshore strata (401, 402 and 403) in 1984 (Fig. 1a), both survey timing and area have been kept constant since 1971 in the September survey. However, past changes in survey vessel, fishing gear and the time of day of fishing have necessitated some corrections to ensure consistency of the time series for many taxa (Benoît and Swain, 2003 a,b). Furthermore, unsampled strata and repeat fishing sets (by a single vessel) at particular locations in certain years, as well as changes in the level and accuracy of taxonomic identification during surveys are all relevant for the proper analysis of the September survey data. Recommendations for dealing with these issues over the period 1971-2002 are documented in Benoît and Swain (2003b).

The research vessel *CCGS Teleost* replaced the *CCGS Alfred Needler* as the survey vessel for the southern Gulf of St. Lawrence multi-species survey in 2006. This report presents results of comparative fishing (paired-trawl) experiments conducted between these vessels in 2004 and 2005. Included are recommendations for the application of those results, as well as further recommendations for dealing with issues related to taxonomic identification during the survey, and also with issues related to survey coverage during the period of 2003-2005. The recommendations contained herein are in addition to those contained in Benoît and Swain (2003b) and supersede them only where specifically indicated.

1.1 BACKGROUND

Fishing during the September survey was carried out by the *E.E. Prince* from 1971-1985 using a Yankee-36 trawl and subsequently by four vessels each using a Western IIA trawl: the *Lady Hammond* (1985-1991), the *CCGS Alfred Needler* (1992-2002, and 2004-2005), the *CCGS Wilfred Templeman* (2003) and the *CCGS Teleost* (2004-2005). Specifications of the first three vessels and both gears can be found in Nielsen (1994) or Hurlbut and Clay (1990). Details on the *CCGS Wilfred Templeman* and the *CCGS Teleost*, fifty and sixty-three meter stern trawlers respectively, can be found at: http://www.ccg-gcc.gc.ca/fleet/main_e.asp.

Prior to the vessel/gear changes that occurred in 1985 and 1992, comparative fishing experiments were conducted to determine the efficiency of the new vessel relative to the one being replaced (see Benoît and Swain 2003b). The *CCGS Alfred Needler* was unavailable for

the 2003 survey, and was temporarily replaced by the *CCGS Wilfred Templeman*. Comparative fishing experiments between these vessels using the Western IIA trawl have not taken place. Their relative fishing efficiency is therefore not known but is expected to be very similar as the two vessels are of the same design and few differences in efficiency were found between them using a different trawl (Cadigan et al 2006). The *CCGS Teleost* replaced the *CCGS Alfred Needler* for the September survey in 2006. In preparation for this, comparative fishing experiments therefore took place in 2004 and 2005 to intercalibrate these vessels. One-hundred and eighty paired fishing tows were planned for each year. However, due to mechanical problems and a labour dispute, the *CCGS Alfred Needler* was available for only a small portion of the 2004 survey. Consequently, only eleven comparative fishing sets were completed that year and the *CCGS Teleost* undertook the regular survey sampling. Inclement weather in 2005 resulted in only ninety comparative fishing sets being successfully completed and prevented either of the vessels from completely sampling the survey area, though they accomplished this jointly.

Comparative fishing experiments between the *CCGS Alfred Needler* and the *CCGS Teleost* using the Western IIA trawl also took place during the February survey of George's Bank, the March survey of NAFO areas 4VsW and the July survey of the Scotian Shelf (NAFO 4VWX and 5Ze). The latter experiment covered a biotic community that is similar to that of the southern Gulf in many respects, during a season when the behaviour of those biota should also be comparable. The results from the July experiment were therefore combined with those from the southern Gulf, given the relatively small overall number of successful comparative fishing sets and resulting lower statistical power for the latter.

A final important background item for the southern Gulf survey is to note that fishing was restricted to daylight hours (07:00-19:00) from 1971 to 1984 but has been extended to 24 hours per day since 1985. Because it is well known that fishing efficiency can vary by time of day (e.g., Benoît and Swain, 2003a; Hjellvik et al. 2002; Casey and Myers 1998) as a result of species-specific diel behaviours such as vertical migrations, hiding and trawl avoidance, it is necessary to correct survey catches to a standard time of day in order to maintain a consistent time series prior to and after 1985. A summary of such corrections for 51 fish and 13 invertebrate taxa in the September survey up to 2002 can be found in Benoît and Swain (2003b). The present report provides similar recommendations for the surveys post-2003.

2. METHODS

2.1 COMPARATIVE FISHING EXPERIMENTS

Comparative fishing in the southern Gulf between the *CCGS Teleost* and the *CCGS Alfred Needler* using the Western IIA trawl took place during the regular 2004 and 2005 surveys, specifically from September 15-16, 2004, and September 11-26, 2005. As in the regular annual surveys, fishing locations were selected randomly within strata (Fig. 1a) and standard protocols were followed. The vessels fished side-by-side (≤1 n. mile apart) and the relative position of the vessels (port or starboard) alternated at each station. The target fishing procedure was a 30 minute tow at 3.5 knots. Paired fishing was successfully conducted at 11 and 90 stations respectively during the 2004 and 2005 comparative fishing experiments (Fig. 1b). The taxonomic and common names of species covered by this study are listed in Appendix I.

Comparative fishing between the aforementioned vessels on the Scotian Shelf also took place during the regular survey of that area, from June 27 to July 26, 2005. Note that attempts to undertake comparative fishing during the 2004 July survey were unsuccessful. Protocols were as described above, with 173 successful comparative sets completed. Only the catches for those species of fish, crabs and squid which were also captured in the September survey were analysed. As a result of problems distinguishing white hake (*Urophycis tenuis*) from red hake (*Urophycis chuss*) in certain geographic areas of the Scotian shelf, only catches from NAFO division 4V (July survey strata 440-451) were selected (J. Simon, DFO Maritimes Region, personal communication). Likewise, because of difficulties distinguishing winter skate (*Leucoraja ocellata*) from little skate (*Leucoraja erinacea*) below a length of 55 cm, only larger fish of the former species were included in the analyses (J. Simon, DFO Maritimes Region, personal communication). Neither red hake nor little skate occur in the southern Gulf. Results from the Scotian Shelf comparative fishing experiments are presented here only in combination with those from the southern Gulf experiments and therefore are not explicitly presented in detail.

2.2 Analysis of Relative Fishing Efficiency of Vessels

The goal of the analyses presented here was to estimate the relative fishing efficiency of the *CCGS Alfred Needler* (denoted *N*) and the *CCGS Teleost* (*T*). Two approaches were used: a fixed effects conditional distribution model (McCullagh and Nelder, 1989) and a mixed effects model (Pinhero and Bates, 2000). Each is described in turn in more detail later in this section. Past analyses of southern Gulf of St. Lawrence comparative fishing data adopted the former approach (e.g., Benoît and Swain, 2003b). Recently, Cadigan et al. (2006) proposed using mixed random-effects models to analyze these types of data, as is increasingly being done in gear selectivity studies (e.g., Millar et al. 2004). They concluded that mixed effects models were advantageous because they produced apparently more reliable statistical inferences (i.e. confidence intervals) and could better account for comparative fishing data outliers, as compared to their fixed effects counterparts. However, they stated that simulations are required to ensure the robustness of the results. Although this work is underway (N. Cadigan, personal communication), in the absence of conclusions, I have undertaken the analyses using both approaches, allowing for the evaluation of sensitivity to outliers and the consistency of results between approaches.

Throughout this section, C_{iv} and C_{ilv} will denote the total number and the number at length l, respectively, of fish, crabs or squid caught in the i^{th} paired-fishing set by vessel v = (N or T).

2.2.1 Fixed effects model

Under the fixed effects approach, the conditional distribution of C_{iN} given the toal catch $C_i = C_{iT} + C_{iN}$ was used and the relative fishing efficiency of the vessels was evaluated using a generalized linear model, with a logit link and a binomial error distribution (McCullagh and Nelder, 1989). Such a model evaluates the probability, $p_i = C_{iN} / C_i$, that a fish captured in set pair i will have been captured by the *CCGS Alfred Needler*, relative to the probability that the *CCGS Teleost* will have captured this fish, 1- p_i. If there is no difference in fishing efficiency between the vessels for the given species, then p_i = 1- p_i = 0.5. However, if a difference exists in relative fishing efficiency, 1- p_i must be multiplied by a relative catchability term (b_v) to maintain this equality. This relative catchability term is a function of the estimated intercept parameter of a logistic regression (β_v is termed the *vessel effect* hereafter):

$$(1)\ \ln\left(\frac{p_i}{1-p_i}\right) = \beta_v; \qquad \text{where } \exp(\beta_v) = b_v$$

The left side of the equation is the logit transformation of p_i.

Adjustments to (1) are required because of variations in tow distance (d_{iv}) and subsampling of catches. While the target fishing procedure was a 30 minute tow at 1.75 knots, variation in realized speed over the ground and occasional pre-emptive (early) haul-back due to problematic trawling conditions (e.g., rough bottom) resulted in differences in d_{iv}. Furthermore, representative length-frequencies were obtained for all fish species, most crab species and squid during each set, and subsampling was occasionally used when catches were large (>200 individuals). An offset term, $\log_e(d_{iN}\ f_{iN}\ /\ d_{iT}\ f_{iT})$ was therefore included in the logistic regression model to account for these sources of variability (McCullagh and Nelder, 1989), where f_{iv} is the fraction (by weight) of the catch for which individuals were measured and counted. An offset term is essentially a covariate that has a slope fixed at one. This is described in more detail later in Section 2.2.2. The model was estimated using the maximum likelihood approach.

Though model (1) can easily handle catches of zero fish for a given species, it is obvious that a null catch for both vessels carries no information about their relative fishing efficiency and inappropriately inflates the degrees of freedom, making nominal tests of significance more liberal. As a result, only set pairs in which a given species was captured by at least one of the vessels were included in the analysis (termed *relevant set pairs* hereafter). Inclusion of set pairs where one vessel caught no fish is necessary to properly evaluate differences between vessels in the probability of capturing those fish.

Model (1) assumes that individual fish are captured independently, i.e., in the absence of a difference in fishing efficiency between vessels, each fish has an equal probability of being captured by either vessel. This may not always be an appropriate assumption given that fish often aggregate spatially and are therefore not captured independently. To allow for such a departure, an extra-binomial model is generally used in which overdispersion is modelled using a scale parameter ϕ that increases the model variance when the data are overdispersed (ϕ>1), but does not affect the parameter estimates. However, previous experience with similar models used to estimate diel and vessel effects on relative catchability (Benoît and Swain 2003a,b; Casey and Myers 1998) has suggested that this approach does not completely account for the true variability in the data, resulting in overly liberal tests of nominal statistical significance. As a result, statistical significance was assessed using randomization tests (Manly 1991) under the null hypothesis of no difference in fishing efficiency between vessels. The Pearson Chi-Square statistic (McCullagh and Nelder, 1989) was used as the test statistic. Nine-hundred and ninety-nine permutations were used with one C_{iv} from each relevant set pair being randomly assigned to the *CCGS Alfred Needler*, and the other to the *CCGS Teleost*. For species where there were fewer than 12 relevant set pairs (s) and for which nominal tests were statistically significant, randomizations were limited to all possible permutations of the data (2^s). Statistical significance was given by $(n+1)/N$, where N is the total number of permutations of the data (including the original result) and n is the number of random permutations that yielded a test statistic equal to or greater than that of the original observed result.

Model (1) can easily be modified to incorporate covariates that might affect the relative catchability of species between vessels, such as fish body length (or crustacean carapace

width), fishing depth and time of day (e.g., Benoît and Swain 2003a; Pelletier 1998). The magnitude of the covariate effect is effectively estimated as the slope (β_1) in the case of length and depth, from the logistic regression:

$$(2)\ \ln\left(\frac{p_i}{1-p_i}\right) = \beta_v + \beta_1 \cdot \text{covariate}; \quad \text{where } \exp(\beta_v + \beta_1 \times \text{covariate}) = b_v$$

As with Model (1) an offset term was included in fitting model (2) and statistical significance of the covariates was assessed using 999 randomizations. In order to isolate the probability of the covariate alone, statistical significance was assessed using randomizations of the covariate effect while maintaining the original vessel effect. In other words, the allocation of an observed catch to a particular vessel was not permuted, however catches from set pairs were randomly allocated to the observed levels of the covariate (i.e., in the same proportion as originally observed). As a result of limited sample sizes, the significance of each covariate was assessed in a separate analysis.

2.2.2 MIXED EFFECTS MODEL

Although the vessels fished as closed together as possible during the paired-trawl experiments, it was not possible to ensure that exactly the same local stock densities were fished by both vessels. The fixed-effect model assumption that a fish captured in set pair *i* had an equal probability under the null hypothesis of being captured by either vessel is therefore not generally insured. Failure to account for differences in local densities encountered by each vessel in gear size-selectivity studies is known to lead to underestimated parameter standard errors and overly liberal tests of significance (Millar et al, 2004), likely explaining the aforementioned results obtained by Benoît and Swain (2003a,b) and Casey and Myers (1998). Unlike the fixed effects model, a mixed effects model that assumes that both vessels encounter the same local density of fish (λ_{il}) only <u>on average</u> can be formulated. If $\delta_i = \ln(\lambda_{iN} / \lambda_{iT})$ and $z_i = \log_e(d_{iN} f_{iN} / d_{iT} f_{iT})$ denotes the offset term described above, the mixed effects version of (1) can be written as

$$(3)\ \ln\left(\frac{p_i}{1-p_i}\right) = \beta_v + z_i + \delta_i \qquad \text{where} \quad \delta_i \sim N(0, \sigma^2)$$

In this model, the δ's are (unobserved) random variables and β_v is treated as a fixed effect parameter. Because (3) contains both fixed and random effects, it is referred to as a mixed effects model.

Cadigan et al. (2006) considered these random effects in an analysis of the length-dependent relative catchability of two vessels where $\delta_{il} = \log_e(\lambda_{ilN} / \lambda_{ilT})$ and,

$$(4)\ \ln\left(\frac{p_{il}}{1-p_{il}}\right) = \beta_v + \beta_1 l + z_{il} + \delta_{il}$$

If an identical length distribution of fish were encountered by both vessels in *i* then $\delta_{il}=0$. However, the authors point out that in practice the length distributions can differ, with differences possibly occurring systematically with length. Consequently in addition to the

assumption of Normally-distributed random effects, they assumed that the δ's were autocorrelated (first-order) in terms of length but independent between sets. Both β_v and β_1 were treated as fixed effects. Because the model can account for smooth deviation from linearity in the logit proportion of *Alfred Needler* (in the present case) catches caused by partly systematic differences in local stock density fished by each vessel, an additional over-dispersion parameter as in the fixed-effects case is not needed.

The approach of Cadigan et al. (2006) was applied to the analysis of comparative fishing data from the southern Gulf using the SAS procedure GLIMMIX for estimation (SAS Institute Inc. 2005). This procedure fits generalized linear mixed models based on linearization. The default estimation method known as *residual pseudo-likelihood with a subject-specific expansion* was used.

2.2.3 Analysis of Catches of Other Invertebrates and Miscellaneous Taxa

The models described in sections 2.2.1 and 2.2.2 are based on discrete probability distributions. They therefore apply to the number of individuals caught but not to the weight caught (a continuous variable). For most invertebrates captured in the survey, only the total catch weight in a set is recorded. Different models were therefore required to analyse those catches. Linear models with an identity link and normal error were used. Taking W_{iv} as the catch weight of the species in set i, by vessel v, the following fixed-effects model was used:

$$(5)\ \ln(W_{iv} + 0.001) = s_i + \beta_v$$

where s_i is a factor representing the set and $\exp(\beta_v) = b_v$.

A mixed-effects analog, treating the interaction between the set and vessel effects as a random-effect, was defined as:

$$(6)\ \ln(W_{iv} + 0.001) = s_i + \beta_v + \delta_i \quad \text{where} \quad \delta_i \sim N(0, \sigma^2)$$

2.2.4 Incorporating Data from Different Comparative Fishing Experiments

Throughout the analyses, the data from the southern Gulf in 2004 and 2005 were treated as coming from a single experiment. The small number of set pairs in 2004 prevented a rigorous assessment of a year effect on the relative efficiency of the two vessels. Furthermore, a common (though not ubiquitous) assumption in the analysis of research survey data is that catchability by a particular vessel and gear is generally constant over time, hence a constant relative catchability between vessels.

As stated previously, the experiments conducted on the Scotian Shelf in July 2005 were very comparable to those from the southern Gulf in species composition, season and, to a lesser extent, habitat. Judicious combining of the data from those surveys was considered advantageous in increasing sample sizes and possibly increasing the contrasts in fish abundance or covariate magnitude among set pairs. Where sample sizes permitted, I tested for an effect of survey, treated as a binary fixed factor, in models (1) and (3) and an interaction between survey and the covariates in models (2) and (4). For the fixed effects models, randomizations were used to test the significance of the *survey* factor or interaction by randomly allocating set pairs to the surveys, in their original proportion. For the mixed effects models, Type-III tests were used. Survey data were combined for further analyses where the

effect was not significant at a Type-I error rate of 5%. Nonetheless, results of both the September-only and combined September-July (where appropriate) analyses are presented here. Note that in the results tables, blank entries for the test of a survey effect and the combined September-July analyses indicate that there were too few sets in the July survey that captured the species in question to include those sets.

2.2.5 *OUTLIERS*

During each series of analyses, the standardized residuals from the model fit were examined to identify outliers and sets pairs with potentially inflated leverage in the analysis, and to ensure whether a proposed model was appropriate when covariates were included (Figs 3-49). Cases with possible outliers or unduly influential set pairs (listed in Appendix II) were removed and the analysis was repeated, along with another assessment of the residuals. Results of these analyses as well as those including all sets are presented here.

Preliminary analyses confirmed the results of Cadigan et al. (2006) that mixed effects models were generally less sensitive to outliers. The magnitude of outlying Pearson residuals and the frequency of clear outliers were considerably less than in the fixed effects models. However, to better examine the robustness to outliers, those identified in the fixed effects analyses were removed and the mixed effects analyses were then repeated.

2.2.6 *INTER-VESSEL DIFFERENCES IN TOW DISTANCE*

Adjusting the model to reflect relative catches per tow distance using the offset is likely insufficient to compensate for between-vessel differences in tow duration if these differences can be large and the relationship between catch amount and tow duration/distance is not linear. Although the differences in tow distance were generally less than 5-10%, some were as high as >50% (Table 1, Fig. 2). Analyses were therefore done including all relevant set pairs and excluding those with a large difference in towed distance. A cut-off of ≥20% difference (corresponding to a difference of 6 minutes or less in tow duration, given a maximum 30 min. tow) was applied to exclude pairs with relatively large differences. Seven set pairs from the September experiments and four from the July experiments were consequently eliminated. In almost all cases, the removed set pairs included only a small percentage of the total experiment-wide catch of the various species (Appendix III). However, of the seven pairs from September, five were cases where the Teleost fished a longer distance than the Needler (Table 1). It is this sort of systematic difference between vessels that could generate a spurious vessel effect for relative catchability.

Because of the somewhat arbitrary nature of the choice in cut-off level, results of analyses that include all data are also reported, permitting an evaluation of the sensitivity of results to the inclusion of these sets.

2.2.7 *TYPE-I ERROR*

A large number of statistical tests were undertaken as part of these analyses, resulting in an experiment-wise Type-I error (i.e., reject the null hypothesis when it is true) rate that was higher than the nominal level. Procedures are available to control the Type-I error rate at a specified level when multiple tests are performed (e.g., Rice 1989). However, these procedures also increase the Type-II error rate (i.e., failure to reject the null hypothesis when it is false). The power of analyses (i.e., the ability to detect a false null hypothesis) of comparative fishing data is already very low (reviewed briefly in Pelletier 1998) due to small

sample size combined with the high variability characteristic of trawl survey catch rates. Thus, no adjusted to significance levels were made to control the Type-I error rate given multiple tests. Experiment-wise Type-I error is however borne in mind on a case-by-case basis when interpreting the results of analyses that are only marginally statistically significant at the 5% level and for which the results were not corroborated by those including the July experiment data.

3. RESULTS

Bivariate plots of *CCGS Teleost* and *CCGS Alfred Needler* catches (# fish·tow^{-1}), relative length frequencies from the 2004 and 2005 September and 2005 July comparative fishing experiments and diagnostic plots (residuals and random effects) from the various analyses are presented in Figures 3-49 for those fish, crab and squid taxa for which sufficient catches were made. Bivariate plots of catches (kg·tow^{-1}) for the remaining invertebrate taxa for which sufficient catches were made are presented in Figures 50-51.

In this section, a general description of analysis results is presented, focussing on cases where the probability of the data given the respective hypothesis was near or below 5%. Species-specific recommendations for the application of vessel conversion factors in light of brief summaries of results are presented in section 4.

3.1 VESSEL EFFECTS (NO COVARIATES) – FISH, CRABS AND SQUID

3.1.1 FIXED-EFFECTS MODEL

Vessels effects were assessed for about 50 species of fish, five crab species and for long-finned squid (Table 2). Restricting the analysis to sets pairs where the distance towed differed by less than 20% between vessels, significant vessel effects were found for white hake, Greenland cod, daubed shanny and the toad crab *Hyas araneus*, as well as marginally significant results (i.e., P~0.05) for American plaice, yellowtail flounder, longhorn sculpin and Arctic alligatorfish. When outlying influential set pairs were removed, significant results were found for Atlantic herring and marginally significant results for Atlantic cod and snow crab. Inclusion of the July data (where appropriate) generally corroborated these results, with a significant effect found for white hake, American plaice (with and without outliers) and yellowtail flounder. Additionally, significant results were found for winter flounder, sea raven (outliers removed), sand lance, snakeblenny, Vahl's eelpout and Northern stone crab. The p-value for cod, increased slightly relative to the analysis of the September-only data.

Analyses including all relevant set pairs, regardless of the relative tow distance, produced similar conclusions for most species (Table 3; Fig. 52). A notable exception was Atlantic cod, where significant results were obtained in the September-only and September-July analyses once outliers were removed. Another was the Atlantic hookear sculpin, where marginally significant results were also found in the combined surveys analysis.

For most of the larger-bodied demersal fishes, β_v had positive values (i.e., Alfred Needler catching relatively more fish), suggesting a possible overall vessel effect despite a lack of nominal statistical significance in many cases.

3.1.2 MIXED-EFFECTS MODEL

The mixed-effects model fit the data very well, with approximately normally-distributed residuals and random effects for the majority of species (Figs. 3-49). The magnitude and frequency of apparent residuals was considerably less than their fixed-effects counterparts. The estimated vessel effect and its associated standard error were also less sensitive, though not insensitive, to the removal of a small number of data points identified in the fixed-effects analysis (Table 4; e.g., cod, witch flounder, arctic staghorn sculpin).

The analysis nonetheless produced very similar conclusions to the fixed-effects model (Fig. 53). Significant vessel effects were obtained for white hake, American plaice, Atlantic herring (September-only data, outliers removed), Greenland cod, longhorn sculpin, moustache sculpin, snakeblenny, daubed shanny, Atlantic hookear sculpin and the toad crab (Table 4). Inclusion of all relevant set pairs, regardless of relative tow distance, had a similar effect as in the fixed-effects analysis. A nominally significant vessel effect was found for cod when outliers were removed (September and combined-survey analyses), though the effect was marginally significant when sets were also selected based on relative tow distance.

As in the fixed-effects analysis, β_V had a positive value for most of the larger-bodied demersal fishes.

3.2 LENGTH-DEPENDENT VESSEL EFFECTS – FISH, CRABS AND SQUID

3.2.1 FIXED-EFFECTS MODEL

A statistically significant length-dependent difference in catchability between the *CCGS Alfred Needler* and *CCGS Teleost* was established for herring, Greenland cod and daubed shanny, with more marginally significant results for winter flounder (excluding outliers), capelin, longhorn sculpin (including outliers) and toad crab in the September comparative fishing experiments (Table 6). In the case of the Greenland cod, possible confusion with Atlantic cod at smaller sizes, combined with a small number of total fish caught, suggests that its result may not be reliable. In the combined September-July analysis, a significant effect of length was found for American plaice, moustache sculpin and alligator fish. A significant 'survey' effect precluded testing for a length effect in many of the species for which that effect was significant based on the September-only data. One exception was capelin, for which the length effect was not significant, unlike in the September-only analysis. These results are comparable to those obtained when all relevant set pairs are included, regardless of relative tow distance (Table 7).

3.2.2 MIXED-EFFECTS MODEL

A significant effect of length was found for daubed shanny using the September data, and for American plaice (excluding outliers), alligatorfish and sand lance using the combined surveys data. Marginally significant results were obtained for redfish (combined surveys), herring, gaspereau, moustache sculpin, spatulate sculpin, sea poacher, stout eelblenny and toad crabs (September-only, but not the combined analyses) (Table 8). There is therefore general concordance with the fixed effects analysis. Likewise for analyses including all relevant set pairs (Table 9).

3.3 Depth-Dependent Vessel effects – Fish, Crabs and Squid

There were very few instances of significant depth effects in the fixed effects model analysis of the comparative fishing data (Table 10). The four cases that were nominally significant had p-values very close to 5%. Furthermore, based on binomial probability with ~100 statistical tests, as presented in this table, and α=5%, we would expect approximately 8-9 tests to produce nominally significant results by chance alone five percent of the time. Additionally, there was no inter-species consistency in the sign of the depth effect that would suggest an overall effect. This was also true for the mixed effects analysis (Table 12) and for analysis based on all relevant set pairs (Tables 11 & 13).

3.4 Diel Differences in Vessel effects – Fish, Crabs and Squid

Benoît and Swain (2003a) found significant diel differences in the catchability of many species to the September survey, presumably related to diurnal changes in vertical position in the water column, hiding behaviours or visual net avoidance. Differences between vessels in factors such as vertical trawl opening and door stability (inasmuch as it affects sediment re-suspension) could conceivably result in diel-dependent differences in relative vessel catchability. However, preliminary fixed effects analyses based on model (2), with time-of-day treated as a binary factor (day, 7:00-18:59), provided little support for such an effect (Table 14). As with the analyses of an effect of depth, significant diel effects were found for only two species, at p-values close to 5%. Furthermore, most of the catches of these two species were made during the night, thereby preventing a proper estimation of the diel effect. Consequently diel-dependent differences between the two vessels appear to be negligible. This isconsistent with the findings of Benoît and Swain (2003a) that conversion factors for particular species tended to be very similar between vessels and even surveys. As a result, any further analyses of the effect using mixed-effects models were not pursued.

3.5 Vessel effects – Other invertebrates and Biological Material

For invertebrates other than the large crabs and squid, only analyses based on weights of organisms captured were undertaken (Figs. 50-51; Table 15). Given the results for fish and preliminary analyses for the invertebrates, depth-dependent differences in fishing efficiency were not further explored.

Across most of the smaller-bodied invertebrate taxa (e.g. shrimp, hermit crabs, bristle worms, whelks, brittle stars and the sea cauliflower, *Gersemia rubiformis*) the majority of the set pairs where only one vessel captured the taxa had the *CCGS Alfred Needler* reporting the null catch (Figs 50-51). This is likely the result of a lower degree of vigilance aboard this vessel when sorting the catch of these smaller invertebrates by taxon. Indeed, there were 33 set pairs in which the *CCGS Alfred Needler* reported a catch of "miscellaneous unidentified remains", a catch-all category used to report quantities of unsorted non-fish catch, compared to 7 pairs aboard the *CCGS Teleost* (Fig. 51). Clearly, this systematic lower degree of sorting vigilance on one vessel across a large number of set pairs puts into question any vessel conversion factors derived for the taxa in question as the relative catchability of those taxa may not be properly reflected. Unfortunately, there is no reliable solution to deal with the bias, short of conducting additional comparative fishing sets with a stricter sorting regimen. To get an idea of the bias that this may have caused however, analyses were conducted including all set pairs as well as excluding those where one of the vessels reported both a null catch and a catch of "unidentified remains". It should be noted though that the latter approach has the disadvantage

that it may omit data that reflect a true vessel effect on catchability and does not fully account for the bias in cases where the catch of a taxon was partially sorted.

For the majority of taxa, no differences between vessels in relative catchability were found. The following text focuses on the exceptions.

There are over a dozen species of shrimp captured by the September survey. While there have been recent efforts to identify the catches of shrimp by species post survey using collected samples, species-level catch data were not available at the time these analyses were conducted. Analyses were therefore based on aggregate shrimp biomass. Significant vessel effects were found in two of the mixed-effects model analyses (Table 15). However, when sets with unsorted invertebrate catches were removed, the effect was no longer significant.

For three other taxa, bristle worms, Iceland scallop and brittle stars, though significant differences were found, there were very few sets in which both vessels captured the species. In the case of brittle stars, when both vessels reported a capture, the Needler recorded more biomass (suggesting a higher catchability), however there were also a large number of sets in which the Teleost recorded brittle stars but the Needler reported a null catch (suggesting a lower probability of capture). Because we cannot rule out that this apparent contradiction is not a spurious result of sorting vigilance, the current comparative fishing data for this and the other two species.

A significant vessel effect, robust to the removal of set pairs reporting unsorted catch, was established in fixed and mixed-effects analyses of empty mollusk shell catch (Table 15). The Teleost tended to catch approximately 1.8 times as many shells as the Needler. Though similar results were obtained for sea cauliflower, marine plants and algae, and woody debris, probabilities under the null hypothesis were close to the type-I error rate of 5%. Application of conversion factors for these taxa is therefore unadvisable. Should ensuring the continuity of time series for these taxa become a priority (currently it is not), additional comparative fishing would be required to better estimate the conversion factors.

4. DISCUSSION AND RECOMMENDATIONS

4.1 RECOMMENDATIONS –COMPARATIVE FISHING EXPERIMENT RESULTS

The following table provides a summary of results from the various analyses for all commercially important fish species and all other taxa for which statistically significant results were obtained in at least one of the analyses. Recommendations for the application of conversion factors, where appropriate, based on these results are also provided. Where results were quantitatively similar among like analyses, conversion factors estimated in the mixed effects model analyses including only set pairs with less than a 20% difference in tow distance should be used given the stronger conceptual basis for those inferences relative to the fixed-effects model equivalents. These results are found in Table 4 for length aggregated results and Table 8 for length-dependent results.

Consistent with the recommendations of Swain et al. (1995), recommendations are presented such that catches are calibrated to the current vessel (i.e., *CCGS Teleost*), as doing so necessitates no annual adjustments of catches as additional data are collected. (Note that standardizing to another vessel is trivial, see eqn. 1). In light of the non-significant results of analyses including a diel effect presented in section 3.4, these are not considered in this table.

Until sufficient data are collected to reliably estimate conversion factors for diel differences in catchability for the *CCGS Teleost* those derived for the *CCGS Alfred Needler* (documented in Benoît and Swain 2003b) should be used. There are about 40 fish and 7 invertebrate taxa for which diel differences in catchability to the *CCGS Alfred Needler* have been established.

Species (code)	Observed effects	Recommendation
Atlantic cod (10)	• The probability of the September only data under the null hypothesis of no vessel effect when outliers are excluded varies around a value of 5%, depending on the analysis. A 10-20% difference in fishing efficiency between vessels is estimated. • *P*~0.1 in the fixed and mixed effects combined-surveys analyses, excluding outliers and sets with large differences in tow distance. • No significant effect of length • When the outlier set is removed, there is very little difference between vessels in the total length frequency (Fig. 54). Applying the marginally insignificant length-aggregated conversion factor does little to change the similarity in catch of the two vessels.	It is most reasonable to base the recommendation on analyses that exclude sets pairs with disparate towed distances for the reasons stated earlier. In those cases, the probability of the data under the null hypothesis are close to but above the somewhat arbitrary 5% level. This result, in light of the multiple statistical tests performed and the risk of committing Type-I errors, does not provide compelling evidence for a difference in catchability between the vessels. It is therefore recommended that no correction be applied for cod. However, a possible difference in catchability should be acknowledged as a potential source of bias in future assessments for this species. With a sufficient number of years following comparative fishing, it should be possible to test if this is the case by splitting the Alfred Needler and Teleost time series in the sequential population analysis and estimating the catchability of cod to the survey independently for each.
White hake (12)	• Significant vessel effect in the analysis of the September data and in combined analyses with the July data. • No significant effect of any covariates.	Based on the results of the September only and combined analyses, divide *Needler, Hammond* and *E.E. Prince* catches by 1.32 to obtain Teleost equivalents. Applying this conversion factor improves the similarity between vessels in the total length frequency from the experiment (Fig. 54).
Redfish (23)	• All analyses non-significant	No conversion factor for this species
Atlantic halibut (30)	• All analyses non-significant, though sample sizes are small	No conversion factor for this species

Species (code)	Observed effects	Recommendation
Greenland halibut (31)	• All analyses non-significant	No conversion factor for this species
American plaice (40)	• Significant vessel effect in the analysis of the September data and in combined analyses with the July data (with and excluding outliers). • Significant length-dependent vessel effect in the combined analysis with July data (fixed and mixed effects models), but not in the analysis of the September data only.	Given the observation of no length-dependencies in the analysis of the September data despite a relatively large number of paired sets (90), recommend using a length-aggregated conversion only. b_v (mixed) Sept=1.18 b_v (mixed) Sept-Jul=1.13 Based on the results of the September only and combined analyses, divide *Needler* and *Hammond* catches by 1.15 to get Teleost equivalents. Applying this conversion factor improves the similarity between vessels in the total length frequency from the experiment (Fig. 54). Note that catches by the *E.E. Prince* are multiplied by 1.24 to get *Teleost* equivalents, given an existing conversion factor of 1.43 to yield *Needler* equivalents (see Benoît and Swain, 2003b).
Witch flounder (41)	• All analyses non-significant	No conversion factor for this species
Yellowtail flounder (42)	• Marginally significant vessel effect in the fixed-effects model analysis. Non-significant effect in the mixed effects model analyses. • Non-significant effect of length in all analyses	No conversion factor for this species
Winter flounder (43)	• Marginally significant vessel effect in the fixed-effects model combined surveys analysis when outliers are removed. Non-significant effect in the mixed effects model analyses. • Significant length-effect in fixed-effects model analysis	Given the non-significant results in mixed-effects model analyses, recommend using no conversion factors for this species

Species (code)	Observed effects	Recommendation
	excluding outliers (P=0.01). Non-significant effect in the mixed effects model analyses (P>0.5).	
Atlantic herring (60)	• Significant vessel effect in the analysis of the September data in fixed and mixed effects models when outliers are removed. • Vessel effects in the combined analysis with the July data were (marginally) non-significant, where tested. • Marginally significant length dependent vessel effect in both fixed and mixed model analyses using the September data. This is not the case in the combined survey analyses excluding outliers.	Because catches of herring from the July survey occurred in deeper water than in September (catch-weighted mean depth of 142 vs. 48 m) there may be a difference in fish behaviour between the surveys and therefore recommend using the parameter estimates for September only. Both length-aggregated and length-dependent correction factors improve somewhat the correspondence in total length frequencies from the Needler and Teleost in the September experiments (Fig. 54). Because they provide a comparable fit, recommend using the length aggregated conversion factor for reasons of parsimony. Therefore based on the results of the September only and combined analyses, divide *Needler*, *Hammond* and *E.E. Prince* catches by 1.52 to get Teleost equivalents.
Gaspereau / Alewife (62)	• Non-significant vessel effect in the analysis of the September-only and combined surveys data. • Marginally significant (P=0.02) length-dependent vessel effect using the combined surveys data but not the September-only data in the mixed-effects model analysis. Non-significant results in the fixed-effects model analyses	Given the only marginally significant length effect for the combined surveys data but not the September-only data, do not recommend applying any conversion factors for gaspereau. Furthermore, total length frequencies for this species from the July experiment (which caught the most gaspereau) are not consistent with a length effect (Fig. 14)
Capelin (64)	• Non-significant vessel effect in the analysis of the September-only and combined surveys data. • Marginally significant (P=0.048) length-dependent	Given the only marginally significant length effect for the September data but not the combined surveys data in the fixed effects models only, do not recommend applying any conversion factors for capelin.

Species (code)	Observed effects	Recommendation
	vessel effect using the September data, but not when combined with the July data in the fixed-effects model analysis. Non-significant results in the mixed-effects model analyses	
Greenland cod (118)	• Significant vessel effect in the fixed and mixed effects model analyses of the September data. Not captured in the July survey • Significant length-dependent vessel effect using the September data in fixed effects model analysis.	Greenland cod were captured by both vessels in 7 sets and by only one of the vessels in 19 sets. Fewer than 4 fish were generally captured at any one time. Futhermore, there is a possibility that smaller Greenland cod may have been confused with Atlantic cod, which would have a large impact on the estimated conversion factor for the former but not the latter given their relative abundances. Overall this results in very few data with which to meaningfully estimate a vessel effect, be it length aggregated or length-dependent. Recommend applying no conversion factors for this species. However, further comparative fishing would be beneficial in testing for a vessel effect.
Longhorn sculpin (300)	• Marginally significant vessel effect in the fixed and mixed effects model analyses of the September data. Due to a significant *survey* effect, analyses including the July data were not undertaken. • Vessel effect was non-significant in an analysis of the July-only data (β_v = -0.1528±0.1003, n=79, P=0.1317)	Longhorn sculpin were captured by both vessels in 9 sets and by only one of the vessels in 10 sets. A total of fewer than ten individuals were captured in 15 of those relevant set pairs. Given such small sample sizes and catch amount, marginal significance in the September experiments and lack of significance in July, recommend applying no conversion factors for this species. However, further comparative fishing would be beneficial in testing for a vessel effect.
Mailed sculpin (304)	• Significant vessel effect in the analysis of the September data and in combined surveys mixed-effects model	Given non-significant length effects for the September-only analyses and the fact that the observed length range for this species is rather small (4-16 cm),

Species (code)	Observed effects	Recommendation
	analyses. Non significant results in the fixed-effects model analyses. • Significant length- dependent vessel effect in analyses based on the combined surveys data but not the September-only data.	do not recommend applying a length-dependent correction. Recommend applying the length-aggregated conversion factor estimated in the mixed-effects model analysis. Based on those results divide *Needler, Hammond* and *E.E. Prince* catches by 1.37 to get Teleost equivalents. Applying this conversion factor improves the similarity between vessels in the total length frequency from the experiment (Fig. 54).
Spatulate sculpin (314)	• Non-significant vessel effect in either the fixed or mixed effects model analyses of the September-only or combined surveys data • Significant length- dependent vessel effect in the mixed-effects model analysis of the September-only data (P=0.0194), but not in the fixed-effects equivalent	Given that the length effect is not highly significant and the fact that the observed length range for this species is rather small (4-12 cm), do not recommend applying a length-dependent correction. A length-aggregated difference in catchability is not supported by the analyses; a correction is therefore not necessary.
Sea raven (320)	• Sea ravens were captured in only 14 relevant set pairs in September, with only five sets where both vessels captured the species. They were captured in over 60 sets in July. • Significant vessel effect in the combined surveys (P~0.02) but not the September-only analyses.	The estimated correction factor for the length-aggregated combined-surveys vessel effect (b_v=0.76) does not improve the correspondence of total length frequencies of the two vessels in the September experiments (Fig. 54). Given this result and the failure to find strong evidence for a difference in catchability, do not recommend applying any conversion factors.
Common alligatorfish (340)	• Non-significant vessel effect in the fixed and mixed effects model analyses of the September-only and combined surveys data. • Significant length- dependent vessel effect in the fixed and mixed effects model analyses of the combined surveys data, but not the September-	Given the non-significant length effect in analyses of the September-only data, an observed length effect that differs somewhat between the two surveys (Fig. 31b,c) and the fact that the observed length range for this species is rather restricted (4-16 cm), applying a conversion factor for this species for the September survey is not recommended.

Species (code)	Observed effects	Recommendation
	only data.	
Sea poacher (350)	• Non-significant vessel effect in the fixed and mixed effects model analyses of the September-only and combined surveys data. • Weak evidence for a length-dependent vessel effect in the mixed-effects model analyses of the September-only data. Non-significant results for the fixed-effects model analyses.	Given the non-significant length-aggregated effect, only weak statistical evidence for a length-dependent effect and total length frequencies that do not suggest a large length-dependency (Fig. 32b,c), do not recommend applying a conversion factor for this species.
Sand lance (610)	• Sandlance were caught in only 12 relevant set pairs in the September experiments. Catches were more frequent in the July experiments. • Marginally significant vessel effect in combined surveys fixed-effects analysis. • Significant length-dependent effects in fixed-effects and mixed-effects model analyses, with the Teleost catching relatively more small and fewer large fish than the Needler.	Recommend using a length-dependent correction factor for this species. Given the small number of sets from September, recommend using the conversion factor from the combined analysis with the July data To obtain *Teleost* equivalent catches, divide *Needler*, *Hammond* and *E.E. Prince* catches by: exp(-1.3274+0.1084*length). Applying this correction improves the similarity between vessels in the total length frequencies from the experiment (Fig. 54).
Laval's eelpout (620)	Marginally significant (P=0.048) vessel effect in the mixed-effects model analysis of the September data only when all relevant set pairs, including those with large differences in towed distance, are included.	Given that results are not significant when set pairs including disparate towed distances are removed, do not recommend applying a conversion factor for this species for the September survey.
Snakeblenny (622)	• Marginally significant vessel effect in the mixed-effects model analysis of the September data • Significant vessel effect in the fixed and mixed-effects model analyses of the combined surveys data. • No significant length-	Based on the results of the combined surveys mixed-effects model analyses, divide *Needler, Hammond* and *E.E. Prince* catches by 1.96 to get Teleost equivalents. Applying this conversion factor improves the similarity between vessels in the total length frequency from the experiment (Fig. 54).

Species (code)	Observed effects	Recommendation
	dependent effects.	
Daubed shanny (623)	• Significant length-aggregated or length-dependent differences in catchability between vessels in all analyses.	Despite the relatively low amount of length variation in this species (8-15 cm), patterns in length dependent catchability are remarkably similar between the September and July comparative fishing experiments (Fig 38b,c). The Teleost catches relatively more fish smaller than 10-11 cm, and fewer fish larger than that size. Recommend using a length-dependent conversion factor for this species based on the combined September and July data. Therefore divide *Needler*, *Hammond* and *E.E. Prince* catches by exp(-1.7769+(0.1519*length) to get *Teleost* equivalents. Both this correction and the one from the length-aggregated analysis improve the similarity between vessels in the total length frequencies from the experiment, though the former may provide a marginally better fit (Fig. 54).
Vahl's eelpout (647)	• Non-significant vessel effect in the fixed and mixed-effects model analyses of the September data • Marginally significant (P~0.03) vessel effect in the fixed effects model analysis of the combined September-July data. Not so for the mixed effects model.	Given that the vessel effect is not significant for the September data alone and is only marginally significant in the fixed-effects analyses of the combined surveys applying a conversion factor for this species is not recommended.
Atlantic hookear sculpin (880)	• Significant vessel effect in the mixed-effects model analyses of the September- only and combined surveys data, though there were only three set pairs in the July survey in which both vessels captured the species.	There is a distinct possibility of confusion of this species with Arctic hookear sculpin. Prior to 2004, the two species were not identified separately during annual surveys. The confusion may explain a number of cases where one vessel apparently captured one of the hookear sculpin species, while the other did not (Figs. 27 & 28). When the species are combined, a significant

Species (code)	Observed effects	Recommendation
		vessel effect in the mixed-effects model analyses of the September only data is found (P=0.0033). However, the estimated correction factor (b_v=0.42) worsens the correspondence of total length frequencies of the two vessels in the September experiments (Fig. 54). In light of this result and in the absence of more certainty in the taxonomic identification of the species applying a common correction factor for either Atlantic (code 880) or Arctic (306) hookear sculpins is not recommended.
Atlantic rock crab (2513)	• Significant (P=0.0142) vessel effect in the mixed-effects model analyses of the combined surveys data, but not in the September-only analyses. Non-significant fixed-effects model analysis results.	Given that evidence for a vessel effect isn't overly strong and that sample size is relatively small, applying a conversion factor for this species is not recommended. However, further comparative fishing would clearly be beneficial in testing for a vessel effect.
Northern stone crab (2523)	• Non-significant vessel effect in the analyses of the September data. • Significant (P=0.0122) vessel effect in the mixed-effects model combined-survey analyses.	Given that evidence for a vessel effect isn't overly strong and that sample size is relatively small, do not recommend applying a conversion factor for this species. However, further comparative fishing would clearly be beneficial in testing for a vessel effect.
Snow crab (2526)	• Marginally non-significant (P~0.06) vessel effects in the fixed and mixed-effects model analyses of the September data when set pairs with disparate distances towed are removed. • Marginally significant (P=0.049) effect of length in mixed-effects model analysis including all relevant set pairs. When set pairs with disparate distances towed are removed, the probability of the data under the null	Given a non-significant vessel effect despite a relatively large number of paired sets in September (n=85) and a contradictory direction of effect with the July experiments, applying a conversion factor for this species is not recommended.

Species (code)	Observed effects	Recommendation
	hypothesis increases (*P*=0.168). • Analyses of the combined September and July data were not undertaken because of a significant *survey* effect. Indeed the vessel effect from the July survey is in the opposite direction as in the September experiment (for July, the Needler catches more crab (Fig. 45a)).	
Hyas araneus (2527)	• Significant vessel effect in the fixed and mixed-effects model analyses of the September data. • Analyses of the combined September and July data were not undertaken because of a significant *survey* effect. • Marginally significant (*P*~0.02) length-dependent vessel effect based on the September data.	Length-dependent and length-aggregated conversion factors do not appear to significantly improve the correspondence between Needler and Teleost total length frequencies, across the size range for this species (Fig. 54). As a result, do not recommend applying a conversion factor for this species.

As stated previously, comparative fishing using the Western IIA has not taken place between the *CCGS Templeman* and either the *CCGS Alfred Needler* or the *CCGS Teleost*. There is therefore no firm basis to gauge whether catchability of certain species to the survey was different in 2003, when the former vessel undertook the survey of the southern Gulf of St. Lawrence. Although some differences exist, the *CCGS Templeman* and the *CCGS Alfred Needler* are considered sister ships and are therefore expected to have comparable fishing efficiencies when using the same fishing gear. This will have to be assumed until comparative fishing with the *CCGS Templeman* is undertaken. Consequently, conversion factors used when correcting for differences in relative catchability between the *CCGS Alfred Needler* and the *CCGS Teleost* should be applied to the survey catches in 2003. This also includes *CCGS Alfred Needler* specific corrections for diel differences in catchability (Benoît and Swain, 2003b).

4.2 Recommendations – Survey area covered and Repeat sets (2003-2005)

As a result of a delay in commencing the survey and lost time due to inclement weather and search-and-rescue activities, three strata (402, 425 and 436) were sampled with only one fishing set and two strata (438 and 439) were not sampled at all during the 2003 survey. The missed strata pose a particular problem because they are in deep waters that comprise a small overall proportion of the total survey area yet are important areas for many deep-water species. Ignoring these omissions (i.e., implicitly assume that the average catch in the missed strata was equal to the average over the remainder of the survey area) will result in

considerable bias in the estimated abundance of those species whose distribution is largely restricted to deep water in September. As a result, the best approach to use in calculating abundance indices for 2003 is to fill in the missing data cells using a multiplicative analysis with year and stratum as model terms (e.g., Swain et al. 1998). This approach assumes that there is no year x stratum interaction (i.e., no change in distribution between years).

Although the *CCGS Teleost* completely sampled the survey area in 2004, the *CCGS Alfred Needler* also fished a small number of randomly-selected stations not sampled by the former vessel. Once the necessary conversion factors are applied, the sampling results from these stations can contribute to the calculation of the annual abundance index. In 2005, inclement weather prevented either of the vessels from completely sampling the survey area, though they accomplished this jointly. In this case, the combination of *CCGS Teleost* and corrected *CCGS Alfred Needler* sampling results is required to calculate the annual index.

The 2004-2005 comparative fishing experiments resulted in several paired (repeat) sets at various locations in the Gulf during the annual survey (Fig. 1). Because both sets in a pair can contribute to estimating the abundance of species, though not with the same weight as unique sets at a given location, catches from repeat paired sets (Table 1) should be averaged prior to calculating stratified means and variances. Furthermore, during the 2004 survey the two vessels both sampled a number of the same survey stations, though the fishing was not simultaneous (Table 16). Although these sets were not included in the comparative fishing analyses because of the differences between vessels in the timing of fishing, catches in each repeat set pair should be averaged.

4.3 RECOMMENDATIONS – TAXONOMIC IDENTIFICATION

Although the survey protocol since 1971 has been to sort (and record) catches of fish by species, identification at sea is often problematic for some genera or species groups. In some cases, practical guides for use at sea have been developed in recent years to aid in taxonomic identification, though past survey records may be unreliable. The purpose of this section of the report is to document these problematic species or groups and to provide recommendations for dealing with potentially unreliable species accounts in past survey records.

<u>Genus *Alosa* (gaspereau)</u>: No attempts are made to differentiate *Alosa pseudoharengus* (alewife) and *A. aestivalis* (blueback herring), and consequently both fall under the collective name of gaspereau (species code 62).

<u>Genus *Artediellus* (hookear sculpins)</u>: Two species of this genus occur in the survey: Atlantic hookear (*Artediellus atlanticus*, species code 880) and Arctic hookear (*Artediellus uncinatus*, code 306). It is unlikely that these two species were properly separated in past surveys. While efforts have increased since 2004 to separate them, it is not presently clear that it is being done reliably by all survey staff. As a result, for surveys in the past and for the foreseeable future, catches of these species should be grouped at the genus level (code 323) prior to analysis.

<u>Genus *Eumicrotremus* (lumpsuckers)</u>: The lumpsucker commonly captured in the survey is the Atlantic spiny lumpsucker (*Eumicrotremus spinosus*, species code 502). Three records of the rare Arctic species, leatherfin lumpsucker (*Eumicrotremus derjugini*, species code 509), in past surveys are questionable as it is unlikely that survey staff would have been properly able to distinguish it from *E. spinosus* (see Scott and Scott, 1988). Consequently, these records should be grouped with *E. spinosus*.

Genus *Liparis* (seasnails): While attempts are made to identify these fish to the species level, it is felt that this was done inconsistently prior to 2004 and the reliability of some identifications is questionable. The majority of seasnails captured by the survey are dusky seasnails (*L. gibbus*, species code 512) although these have on occasion mistakenly been called striped seasnail (*L. liparis*, species code 504) because of variations in color patterns within the species (Scott and Scott, 1988). Records prior to 2004 of Atlantic seasnail (*L. atlanticus*, species code 503), gelatinous seasnail (*L. fabricii*, species code 505), Greenland seasnail (*L. tunicatus*, species code 506), Gulf seasnail (*L. coheni*, species code 513), and *Paraliparis calidus* (code 868) have not been verified and are questionable given the limited tools that survey staff had at their disposal for proper identifications. New visual guides available on the surveys as of 2004 have considerably improved the taxonomic identification of this genus. Consequently, records of these species should be grouped as *Liparis* sp. (code 500) at least prior to 2004.

Genus Leucoraja (skates): The only species of this genus that occurs in the southern Gulf is winter skate (*Leucoraja ocellata*, species code 204), therefore survey records of little skate (*L. erinacea*, code 203) most certainly represent a misidentification of the former species (McEachran and Martin, 1978; McEachran and Musick, 1975).

Genus *Lycodes* (eelpouts): While attempts are made to identify these fish to the species level, it is felt that this was done inconsistently prior to 2003 and the reliability of the identification is questionable. Although the majority of eelpouts in the southern Gulf survey are Laval's eelpout (*L. lavalaei*, species code 620) and Vahl's eelpout (*L. vahlii*, species code 647), there are records prior to 2003 of Arctic eelpout (*L. reticulatus*, species code 641), pale eelpout (*L. pallidus*, species code 627), polar eelpout (*L. polaris*, species code 628), Newfoundland eelpout (*L. terraenova*, species code 619) and Vachon's eelpout (*L. esmarki*, species code 643). New visual guides available on the surveys as of 2003 have considerably improved the taxonomic identification of this genus, particularly for Vahl's and Laval's eelpouts. Consequently, grouping records of these species at the genus level (code 642) is recommended, at least for records prior to 2003.

Genus *Pholis* (gunnels): Although gunnels are rarely captured in the survey, reports of the banded gunnel (*Pholis fasciata*, code 633) were likely the rock gunnel (*P. gunnellus*, code 621), as the former species occurs only in very shallow water, whereas the later may occasionally be captured in deeper waters (Scott and Scott, 1988).

Genus *Sebastes* (redfish): No attempts are made to differentiate redfishes to species in the southern Gulf surveys, although these would mainly be *S. fasciatus* and *S. mentella*. Past survey records include a small number of accounts of blackbelly rosefish (*Helicolenus dactylopterus dactylopterus*, species code 123), a species with a more southerly distribution (Scott and Scott, 1988). Given that this species would be unlikely to occur in the southern Gulf and that it is also unlikely that survey staff would have undertaken the meristic counts required to differentiate it from the *Sebastes sp.* (Scott and Scott, 1988), these accounts should probably be treated as being redfish (*Sebastes sp.*, code 23).

Genus Urophycis (hake): The only species of this genus that occurs in the southern Gulf is white hake (*Urophycis tenuis*, species code 12). Survey records of red hake (*U. chuss*, code 13) most certainly represent a misidentification of the former species (Scott and Scott 1988; T. Hurlbut, DFO Gulf region, personal communication).

Sub-Family Anoplagoninae (alligatorfish): Two species of this genus occur in the survey: common alligatorfish (*Aspidophoroides monopterygius*, species code 340) and arctic alligatorfish (*Ulcina olrikii*, code 341). It is unlikely that these two species were properly separated in past surveys, though the former species was likely the more common of the two.

While efforts have increased since 2005 to separate them, it is not presently clear that it is done reliably by all survey staff. As a result, for surveys in the past and for the foreseeable future, catches of these species should be grouped at the sub-Family level prior to analysis.

Family Cottidae (sculpins): Some taxa in this family have posed problems when it comes to proper taxonomic identification. The following species have been recorded in the survey but are dubious because these species occupy habitats that are not sampled by the survey:

- Grubby sculpin (*Myoxocephalus aenus*, code 303): this estuarine species could easily have been improperly identified longhorn sculpin (*M. octodecemspinosus*, code 300) given their general morphological similarity. It is not impossible however that grubby sculpin may have been captured in small numbers in the survey.
- Twohorn sculpin (*Icelus bicornis*, code 313): the 35 records of this species in the survey data probably represent a misidentification of spatulate sculpin (*I. spatula*, species code 314), which occurs generally in the area.
- Pallid sculpin (*Cottunculus thomsoni*, code 308): this species has not been confirmed in the Gulf of St. Lawrence (Scott and Scott, 1988). The single record of its occurrence in the September survey may be a misidentification of the polar sculpin (*C. microps*, code 307), whose occurrence in the Gulf has been confirmed. I is also captured occasionally in the survey.

Family Lumpenidae (shannies): One species in particular in this family has posed problems in the survey. Slender eelblenny (*Lumpenus fabricii*, species code 631) have been reported several times in the southern Gulf survey database. A rigorous examination of a large number of individuals tentatively identified as slender eelblenny in 2004 and 2005 found that all individuals were incorrectly identified. The majority of the individuals were actually the much more common daubed shanny (*Leptoclinus maculatus*, species code 623), followed by a smaller number of individuals being snakeblenny (*Lumpenus lampretaeformis*, species code 622) and less than one percent being stout eelblennies (*Lumpenus medius*, species code 632). Based on length frequencies, any fish over 18 cm identified as slender eelblenny in past survey records can reasonably be considered a snakeblenny (this covers about half of the 662 individuals identified as slender eelblennies from 1971-2003). Though the majority of fish below 18 cm are likely daubed shanny, they cannot be reliably attributed to that species, snakeblenny or possibly stout eelblenny. These fish (n=335) should therefore only be treated at the family level, which does not have any large implications for the other species as they are considerably more numerous: daubed shanny (25,000 individuals recorded since 1971), snakeblenny (about 3,000 individuals) and stout eelblenny (about 6,000).

Family Paralepididae (barracudinas): Barracudinas should be grouped to the family level (Paralepididae, code 713) because while the vast majority of instances are of white barracudina (*Arctozenus risso*, species code 712), there are a few unconfirmed survey records of *Paralepis coregonoides* (code 674).

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Table 1. Timing, location, depth and average distance between vessels for each set from the 2004 and 2005 comparative fishing experiments in the southern Gulf of St. Lawrence. The second-last column is the percentage difference in towing distance between vessels (the target fishing procedure was a 30 min. tow at 3.5 knots, yielding a 1.75 n. mile tow).

Year	*Day*	*Time*	*Stratum*	*Set*	*Latitude (decimal degrees)*	*Longitude (decimal degrees)*	*Depth (m)*	*Distance between vessels (km)*	*% difference in distance towed between vessels*	*Teleost fishes further 1=yes*
2004	15	7:02	423	83	47.7842	61.8802	48	1.1	4	1
2004	15	9:14	423	84	47.8690	62.0620	53	0.7	24	0
2004	15	16:05	423	86	47.7225	62.5843	76	1.1	2	0
2004	15	18:34	423	87	47.6363	62.4697	70	1.0	1	0
2004	15	20:27	423	88	47.6368	62.2135	49	1.3	15	0
2004	15	22:56	423	89	47.4738	62.4065	64	0.6	1	1
2004	16	1:22	423	90	47.4155	62.6730	63	0.9	15	0
2004	16	4:20	423	91	47.4078	62.9565	52	0.9	2	0
2004	16	6:46	423	92	47.6390	62.8368	59	1.1	2	0
2004	16	8:46	423	93	47.8357	62.7535	68	0.5	0	0
2004	16	11:12	423	94	47.8532	63.0272	71	0.8	0	0
2005	11	13:57	403	30	45.6922	61.7633	23	0.7	5	0
2005	11	16:42	403	31	45.7913	61.7838	22	0.7	0	1
2005	11	19:36	403	32	45.7712	61.8607	22	0.7	0	0
2005	11	23:58	433	33	45.9372	61.6870	39	0.9	0	0
2005	12	2:37	433	34	46.2205	61.5362	50	1.0	2	0
2005	12	5:39	433	35	46.2175	61.7343	54	0.7	1	0
2005	12	8:51	434	36	46.5273	61.5057	60	1.2	2	0
2005	12	10:59	434	37	46.7003	61.3380	68	1.0	5	0
2005	12	12:58	434	38	46.7275	61.1073	76	0.9	1	1
2005	12	15:35	437	39	46.7487	61.1128	116	0.8	0	0
2005	13	1:58	434	40	46.8858	61.0723	87	0.9	0	0
2005	13	4:38	434	41	46.8913	61.3785	63	1.1	3	0
2005	13	6:42	434	42	46.9600	61.3288	50	0.9	2	0
2005	13	8:30	434	43	47.0372	61.2355	50	1.2	0	0
2005	13	22:06	431	49	46.9705	61.7802	45	0.5	16	0
2005	14	2:32	431	51	46.8850	61.9815	56	0.8	28	1
2005	14	9:15	423	54	47.2268	63.0767	63	1.0	39	1
2005	14	11:19	429	55	47.0642	63.1743	56	0.8	18	0
2005	14	13:48	429	56	46.9122	63.1337	57	0.8	8	0
2005	14	16:11	429	57	46.7593	63.3505	47	1.2	9	1
2005	14	18:13	401	58	46.6663	63.6162	28	0.7	15	0
2005	14	20:27	401	59	46.7142	63.7755	26	1.8	8	0
2005	14	23:05	429	60	46.9677	63.7357	45	0.6	6	0
2005	15	1:04	429	61	47.1202	63.6917	56	1.1	0	1
2005	15	3:20	422	62	47.2185	64.1170	40	0.7	5	1
2005	15	12:55	420	67	47.1863	64.6885	26	0.5	1	1
2005	15	14:10	420	68	47.2542	64.5577	35	0.8	3	1
2005	15	15:53	422	69	47.3768	64.3753	52	0.6	2	1

Year	Day	Time	Stratum	Set	Latitude (decimal degrees)	Longitude (decimal degrees)	Depth (m)	Distance between vessels (km)	% difference in distance towed between vessels	Teleost fishes further 1=yes
2005	15	18:35	423	70	47.3872	63.8015	65	0.9	8	0
2005	15	20:01	423	71	47.3077	63.6743	64	0.9	1	1
2005	16	0:00	423	73	47.2942	63.4278	57	0.4	6	1
2005	16	1:19	423	74	47.4198	63.5920	62	0.9	10	1
2005	16	2:35	423	75	47.4845	63.6150	69	1.0	9	1
2005	16	3:57	423	76	47.5080	63.6858	67	0.8	14	1
2005	16	5:21	423	77	47.5433	63.7958	67	0.7	14	1
2005	16	7:13	422	78	47.5197	64.0585	40	1.0	13	0
2005	16	9:24	422	79	47.5875	64.1490	65	0.8	0	0
2005	16	11:38	420	80	47.6517	64.4802	29	0.8	2	0
2005	16	14:03	422	81	47.6385	63.9907	50	0.6	10	1
2005	16	15:19	422	82	47.7028	63.9398	63	1.5	56	1
2005	16	20:25	423	84	47.6122	63.3962	80	0.9	0	1
2005	16	23:19	423	85	47.6970	62.9302	59	1.0	10	0
2005	17	00:54	423	86	47.7862	62.7927	64	0.6	12	0
2005	17	2:41	423	87	47.6578	62.7147	66	0.9	19	0
2005	17	4:32	423	88	47.5453	62.5223	75	1.0	9	0
2005	17	6:20	423	89	47.4128	62.4635	68	1.1	0	0
2005	17	9:15	428	90	47.5490	62.0545	34	0.7	39	1
2005	17	11:30	423	91	47.7870	62.4198	71	0.6	1	1
2005	17	14:37	424	92	48.0333	62.8565	69	1.1	29	1
2005	17	17:57	424	93	47.9322	63.5912	69	1.1	3	0
2005	17	19:41	422	94	47.9627	63.8447	90	0.8	2	0
2005	17	21:13	422	95	47.8955	64.0060	86	0.9	1	0
2005	17	23:05	420	96	48.0010	64.2552	26	0.9	10	0
2005	18	1:05	420	97	48.0432	64.2928	22	1.0	4	1
2005	18	2:46	417	98	48.1792	64.2690	49	0.6	31	0
2005	18	7:16	416	100	48.3077	63.9370	95	0.9	14	1
2005	18	10:17	416	101	48.5343	64.0887	102	0.6	3	0
2005	18	11:56	416	102	48.5252	63.9875	121	0.8	7	1
2005	18	14:25	416	103	48.4217	63.7667	123	0.5	5	1
2005	18	16:29	416	104	48.2727	63.5557	95	1.1	2	1
2005	18	19:41	417	105	48.2300	64.0708	67	0.8	1	0
2005	18	22:24	417	106	48.2642	64.5428	97	0.8	2	0
2005	19	21:08	419	108	48.0572	65.8047	30	0.9	3	0
2005	20	1:28	419	109	47.7667	65.6167	23	0.8	4	1
2005	20	5:44	419	110	47.8958	65.4877	59	0.8	2	0
2005	20	9:05	418	111	47.8940	65.0725	68	1.0	4	0
2005	20	10:50	418	112	47.9745	64.8737	66	0.8	3	0
2005	20	17:42	422	114	47.9967	63.9547	89	0.9	2	0
2005	20	22:31	416	116	48.4433	63.5462	111	0.9	1	0
2005	21	00:43	416	117	48.5782	63.5893	117	0.8	6	1
2005	21	6:57	416	118	48.6718	63.8083	148	0.8	1	0
2005	22	23:48	415	122	48.7640	63.2078	302	0.8	1	0
2005	23	2:09	425	123	48.5745	63.0438	285	0.8	0	1

Year	Day	Time	Stratum	Set	Latitude (decimal degrees)	Longitude (decimal degrees)	Depth (m)	Distance between vessels (km)	% difference in distance towed between vessels	Teleost fishes further 1=yes
2005	23	4:18	425	124	48.5545	63.0725	251	0.9	0	0
2005	23	9:23	424	126	48.2820	63.0512	68	0.9	2	0
2005	23	11:06	424	127	48.1578	63.1733	70	0.8	0	0
2005	23	15:52	424	129	48.1125	63.1155	66	0.7	2	0
2005	23	21:20	427	131	48.0987	62.3523	67	0.8	1	0
2005	24	3:35	425	134	48.3905	62.1633	312	1.0	9	0
2005	25	17:04	425	145	48.1463	61.2392	329	0.9	1	1
2005	25	20:19	427	146	47.9787	61.3633	61	0.7	6	0
2005	25	23:22	439	147	47.8710	60.7380	261	0.7	2	0
2005	26	1:41	438	148	47.6782	60.5683	126	1.2	1	1
2005	26	4:13	438	149	47.4428	60.4293	104	0.9	1	0
2005	26	6:37	439	150	47.3315	60.1920	294	0.8	2	0
2005	26	9:32	439	151	47.2453	60.2030	202	0.6	0	0
2005	26	12:08	437	152	47.1260	60.4077	164	1.0	6	0
2005	26	14:22	437	153	47.0927	60.4237	154	0.8	3	1
2005	26	16:19	437	154	47.1183	60.5427	170	0.6	1	1
2005	26	18:27	437	155	47.1397	60.7128	167	0.7	2	0

Table 2. Results of fixed effects model analyses of length-aggregated data, with set pairs having ≥20% difference in tow distance removed, testing for (1) a difference in catchability between the *CCGS Alfred Needler* and the *CCGS Teleost* based on the September 2004 and 2005 comparative fishing experiments, (2) an interaction between the vessel and survey effect and (3) a difference in catchability based on the combined September and July comparative fishing experiments, where appropriate. The column *outlier* indicates whether outliers were included (value=0) or excluded (=1) from the analysis. Probability values are based on 999 permutations under the null hypothesis.

		1. September survey data only					2.Survey effect		3. September & July data				
Species	**outlier**	**DF**	β_v	**SE**	χ^2	***P***	χ^2	***P***	**DF**	β_v	**SE**	χ^2	***P***
ATL. COD	0	81	-0.1390	0.0788	3.11	0.5960	12.21	0.2850	187	-0.3094	0.0760	16.55	0.1790
ATL. COD	1	79	0.1171	0.0517	5.12	0.0640	0.40	0.6350	183	0.0994	0.0444	5.00	0.1000
WHITE HAKE	0	20	0.2855	0.0782	13.3	**0.0100**	2.11	0.3620	34	0.2276	0.0636	12.82	**0.0110**
REDFISH (SEBASTES SP.)	0	23	0.0046	0.0972	0.00	0.9810	0.39	0.6400	141	0.1552	0.0846	3.37	0.9250
REDFISH (SEBASTES SP.)	1	23	0.0046	0.0972	0.00	0.9820	0.38	0.6610	132	0.0925	0.0552	2.81	0.9200
ATLANTIC HALIBUT	0	10	0.5554	0.4404	1.59	0.3360	1.11	0.4200	50	0.0718	0.1933	0.14	0.8000
GREENLAND HALIBUT	0	37	0.0001	0.1045	0.00	0.9970	2.42	0.4970	70	0.1292	0.0827	2.44	0.3160
AMERICAN PLAICE	0	89	0.1265	0.0402	9.92	0.0530	0.71	0.5460	231	0.1460	0.0322	20.57	**0.0040**
AMERICAN PLAICE	1	89	0.1265	0.0402	9.92	**0.0380**	2.85	0.2310	230	0.1624	0.0300	29.26	**0.0030**
WITCH FLOUNDER	0	23	0.2902	0.1756	2.73	0.3990	1.77	0.4780	121	0.1404	0.0609	5.31	0.2960
WITCH FLOUNDER	1	22	0.0958	0.1451	0.44	0.7560	0.00	0.9990	120	0.0962	0.0569	2.86	0.4820
YELLOWTAIL FLOUNDER	0	36	0.1828	0.0836	4.78	0.0580	0.01	0.9550	108	0.1888	0.0493	14.70	**0.0120**
WINTER FLOUNDER	0	18	0.5245	0.1863	7.92	0.2440	1.12	0.6210	48	0.4582	0.1105	17.18	0.0910
WINTER FLOUNDER	1	16	0.4582	0.1420	10.4	0.1150	1.14	0.5210	46	0.3963	0.0877	20.43	**0.0160**
STRIPED ATL WOLFFISH	0	5					0.30	0.6300	49	0.1552	0.1934	0.64	0.5330
ATL. HERRING	0	56	1.0122	0.2543	15.8	0.4330	13.41	**0.0280**					
ATL. HERRING	1	50	0.7294	0.0730	99.9	**0.0130**	18.62	**0.0120**					
GASPEREAU	0	6					19.36	**0.0380**					
RAINBOW SMELT	0	8	-0.0096	0.2718	0.00	0.9480							
CAPELIN	0	59	0.1578	0.1155	1.87	0.6280	0.84	0.5630	87	0.2839	0.1936	2.15	0.7460

		1. September survey data only					2.Survey effect		3. September & July data				
Species	**outlier**	**DF**	β_v	**SE**	χ^2	***P***	χ^2	***P***	**DF**	β_v	**SE**	χ^2	***P***
CAPELIN	1	59					9.31	**0.0290**					
ATL. MACKEREL	0	17	-1.2770	0.5677	5.06	0.2700	2.42	0.3693	24	-0.9050	0.4292	4.45	0.3980
LONGFIN HAKE	0	4							28	-0.0255	0.2064	0.02	0.8990
FOURBEARD ROCKLING	0	17	0.0058	0.2457	0.00	0.9630	1.38	0.4570	41	0.1610	0.1762	0.83	0.5210
GREENLAND COD	0	25	0.8973	0.3387	7.02	**0.0050**							
THORNY SKATE	0	21	0.2385	0.1576	2.29	0.2450	0.65	0.5410	98	0.1340	0.0782	2.93	0.2090
SMOOTH SKATE	0	10	-0.1103	0.2292	0.23	0.6190	0.99	0.3560	47	0.1166	0.1617	0.52	0.4990
WINTER SKATE	0	5							16	0.1357	0.3929	0.12	0.8450
ATLANTIC HAGFISH	0	11	-0.0220	0.3310	0.00	0.9950	4.30	0.3000	41	0.6882	0.2310	8.88	0.1640
LONGHORN SCULPIN	0	18	0.9341	0.2301	16.4	**0.0350**	17.39	**0.0160**					
SHORTHORN SCULPIN	0	30	0.0423	0.2159	0.04	0.9150	0.03	0.9100	37	0.0538	0.2011	0.07	0.8690
SHORTHORN SCULPIN	1	29	-0.2127	0.1973	1.16	0.3120	0.38	0.5560	36	-0.1717	0.1883	0.83	0.4010
ARCTIC STAGHORN SCULPIN	0	31	0.6103	0.2454	6.19	0.8120							
ARCTIC STAGHORN SCULPIN	1	30	-0.0281	0.2081	0.02	0.9180							
MOUSTACHE SCULPIN	0	49	0.2707	0.1308	4.28	0.1370	1.43	0.3940	100	0.1509	0.0932	2.62	0.2220
ARCTIC HOOKEAR SCULPIN	0	20	0.1759	0.4133	0.18	0.7840							
SPATULATE SCULPIN	0	38	-0.2195	0.1936	1.29	0.4280							
SEA RAVEN	0	12	0.0876	0.3318	0.07	0.8790	0.80	0.4570	71	-0.2926	0.1289	5.15	0.2540
SEA RAVEN	1	12					1.28	0.2710	69	-0.2655	0.1123	5.59	**0.0190**
ALLIGATORFISH	0	38	0.0030	0.1626	0.00	0.9930	2.11	0.2970	91	-0.1242	0.1114	1.24	0.2770
ARCTIC ALLIGATORFISH	0	26	-0.7763	0.3026	6.58	0.0570							
ATL SEA POACHER	0	36	-0.0964	0.1506	0.41	0.5240	11.51	**0.0110**					
THREESPINE STICKLEBACK	0	13	0.8892	0.3315	7.19	0.3700							
MARLIN-SPIKE GRENADIER	0	7					0.57	0.7060	22	-0.2663	0.1903	1.96	0.3660

		1. September survey data only					2.Survey effect		3. September & July data				
Species	**outlier**	**DF**	β_v	**SE**	χ^2	P	χ^2	P	**DF**	β_v	**SE**	χ^2	P
ATL SPINY LUMPSUCKER	0	23	0.0954	0.2421	0.16	0.6810	2.00	0.3010	48	0.2650	0.1839	2.08	0.1940
DUSKY SEASNAIL	0	38	-0.0348	0.1643	0.04	0.9330	0.84	0.7010	47	-0.0144	0.1516	0.01	0.9610
NORTHERN SAND LANCE	0	10	-2.2011	0.6718	10.73	0.1240	2.05	0.2740	53	1.0721	0.2841	14.24	**0.0120**
NORTHERN SAND LANCE	1	10	-2.2011	0.6718	10.73	0.1310	107.2	0.1170	46	0.7430	0.1769	17.64	**0.0250**
FISH DOCTOR	0	12	0.7445	0.5062	2.16	0.3060							
LAVAL`S EELPOUT	0	43	0.2742	0.1533	3.20	0.1370							
SNAKEBLENNY	0	20	0.4840	0.2517	3.70	0.0970	2.51	0.3140	43	0.7130	0.1634	19.04	**0.0060**
DAUBED SHANNY	0	65	-0.3893	0.0666	34.16	**0.0010**	169.5	**0.0010**					
4-LINE SNAKE BLENNY	0	24	0.2298	0.2581	0.79	0.5180							
STOUT EELBLENNY	0	28	0.1971	0.1126	3.07	0.1060							
OCEAN POUT(COMMON)	0	8					5.52	0.0940	36	-0.4106	0.1895	4.69	0.1150
VAHL'S EELPOUT	0	17	0.4203	0.2281	3.40	0.3680	0.47	0.6660	45	0.5225	0.1440	13.17	**0.0240**
VAHL'S EELPOUT	1	16	0.0718	0.1556	0.21	0.7390	10.51	0.0750	44	0.3794	0.1300	8.52	**0.0300**
WHITE BARRACUDINA	0	6							18	-0.1363	0.2759	0.24	0.6930
ATL. HOOKEAR SCULPIN	0	32	-0.2267	0.2362	0.92	0.5350	4.39	0.3270	55	-0.5233	0.1950	7.20	0.0890
ATL ROCK CRAB	0	15	-0.0599	0.1566	0.15	0.6540	12.38	**0.0430**					
HYAS COARCTATUS	0	67	-0.0272	0.1285	0.04	0.8790	3.37	0.2920					
HYAS COARCTATUS	1	66	-0.1314	0.1185	1.23	0.3650	74.13	**0.0010**					
NORTHERN STONE CRAB	0	10	0.9883	0.5948	2.76	0.1160	1.85	0.2930	41	0.5854	0.2176	7.24	**0.0120**
SNOW CRAB	0	84	-0.0274	0.0772	0.13	0.7910	15.89	**0.0210**					
SNOW CRAB	1	82	-0.1460	0.0669	4.76	0.0710	266.6	**0.0010**					
Hyas araneus	0	43	-0.7651	0.2401	10.15	**0.0100**	64.05	**0.0200**					
SHORT-FIN SQUID	0	23	0.0737	0.2125	0.12	0.7580	0.03	0.9280	128	0.1501	0.1119	1.80	0.6060
SHORT-FIN SQUID	1	23	0.0737	0.2125	0.12	0.7540	0.02	0.9820	127	0.0499	0.1034	0.23	0.8410

Table 3. Results of fixed effects model analyses of length-aggregated data (all relevant set pairs) testing for (1) a difference in catchability between the *CCGS Alfred Needler* and the *CCGS Teleost* based on the September 2004 and 2005 comparative fishing experiments, (2) an interaction between the vessel and survey effect and (3) a difference in catchability based on the combined September and July comparative fishing experiments, where appropriate. The column *outlier* indicates whether outliers were included (value=0) or excluded (=1) from the analysis. Probability values are based on 999 permutations under the null hypothesis.

			1. September survey data only				2. Survey effect		3. September & July data				
Species	**outlier**	**DF**	β_v	**SE**	χ^2	P	χ^2	P	**DF**	β_v	**SE**	χ^2	P
ATL. COD	0	87	-0.0837	0.0790	1.12	0.693	0.00	0.951	197	-0.2323	0.0762	9.30	0.342
ATL. COD	1	85	0.1636	0.0550	8.86	**0.013**	9.16	0.322	193	0.1617	0.0473	11.67	**0.013**
WHITE HAKE	0	20	0.2855	0.0782	13.34	**0.007**	0.05	0.903	35	0.2745	0.0599	21.02	**0.008**
REDFISH (SEBASTES SP.)	0	24	0.0029	0.0957	0.00	0.993	0.44	0.676	147	0.1586	0.0826	3.69	0.922
REDFISH (SEBASTES SP.)	1	24					0.43	0.671	138	0.0980	0.0545	3.24	0.898
HALIBUT(ATLANTIC)	0	10	0.5554	0.4404	1.59	0.330	1.11	0.439	50	0.0718	0.1933	0.14	0.790
GREENLAND HALIBUT	0	38	0.0013	0.1033	0.00	0.997	0.19	0.829	74	0.0449	0.0933	0.23	0.760
AMERICAN PLAICE	0	95	0.1439	0.0383	14.16	**0.022**	1.98	0.319	242	0.1565	0.0311	25.36	**0.005**
AMERICAN PLAICE	1	95					0.34	0.681	241	0.1720	0.0290	35.14	**0.001**
WITCH FLOUNDER	0	23	0.2902	0.1756	2.73	0.359	1.88	0.458	125	0.1367	0.0600	5.18	0.294
WITCH FLOUNDER	1	22	0.0958	0.1451	0.44	0.729	0.00	0.993	124	0.0930	0.0561	2.74	0.506
YELLOWTAIL FLOUNDER	0	40	0.1920	0.0766	6.29	**0.024**	0.00	0.987	114	0.1934	0.0473	16.70	**0.013**
WINTER FLOUNDER	0	19	0.5210	0.1815	8.24	0.246	2.70	0.320	51	0.4189	0.1063	15.53	0.077
WINTER FLOUNDER	1	17	0.4539	0.1381	10.80	0.108	2.37	0.436	49	0.3530	0.0844	17.48	**0.011**
STRIPED ATL WOLFFISH	0	5					0.27	0.681	50	0.1824	0.1938	0.89	0.453
ATL. HERRING	0	60	1.0097	0.2457	16.89	0.443	19.15	**0.015**					
ATL. HERRING	1	54	0.7273	0.0716	103.1	**0.013**	13.92	**0.033**					
GASPEREAU	0	6					19.69	**0.044**					
CAPELIN	0	61	0.1062	0.1212	0.77	0.778	9.74	**0.020**	91	0.2479	0.1893	1.72	0.775
CAPELIN	1	61					1.11	0.510	87	0.2548	0.1034	6.07	0.499
ATL. MACKEREL	0	20	-0.8947	0.4669	3.67	0.416	1.86	0.464	28	-0.6387	0.3733	2.93	0.531
LONGFIN HAKE	0	4					1.06	0.392	29	-0.0264	0.2025	0.02	0.907
FOURBEARD ROCKLING	0	18	-0.0071	0.2404	0.00	0.954	1.89	0.376	44	0.1752	0.1715	1.04	0.487
GREENLAND COD	0	28	0.7283	0.2565	8.06	**0.004**	-	-					
THORNY SKATE	0	21	0.2385	0.1576	2.29	0.239	0.63	0.563	100	0.1364	0.0775	3.10	0.192

			1. September survey data only				2. Survey effect		3. September & July data				
Species	**outlier**	**DF**	β_v	**SE**	χ^2	***P***	χ^2	***P***	**DF**	β_v	**SE**	χ^2	***P***
SMOOTH SKATE	0	10	-0.1103	0.2292	0.23	0.629	0.82	0.357	49	0.0994	0.1623	0.38	0.541
WINTER SKATE	0	5					0.32	0.644	16	0.1357	0.3929	0.12	0.845
ATLANTIC HAGFISH	0	11	-0.0220	0.3310	0.00	0.995	4.05	0.312	42	0.6701	0.2297	8.51	0.172
LONGHORN SCULPIN	0	20	0.9203	0.2256	16.64	**0.040**	17.80	**0.014**					
SHORTHORN SCULPIN	0	32	0.0370	0.2122	0.03	0.910	0.38	0.554	39	0.0488	0.1983	0.06	0.889
SHORTHORN SCULPIN	1	31	-0.2142	0.1951	1.21	0.317	0.03	0.901	38	-0.1737	0.1863	0.87	0.393
ARCTIC STAGHORN SCULPIN	0	36	0.3909	0.2391	2.67	0.899	-	-	36	0.3909	0.2391	2.67	0.905
ARCTIC STAGHORN SCULPIN	1	35	-0.1838	0.1981	0.86	0.554	-	-	35	-0.1838	0.1981	0.86	0.534
MOUSTACHE SCULPIN	0	51	0.2171	0.1253	3.00	0.164	0.87	0.499	103	0.1299	0.0905	2.06	0.263
ARCTIC HOOKEAR SCULPIN	0	22	0.0820	0.3836	0.05	0.892	-	-	23	0.1021	0.3755	0.07	0.879
SPATULATE SCULPIN	0	41	-0.3075	0.1945	2.50	0.249	-	-	44	-0.2604	0.1909	1.86	0.310
SEA RAVEN	0	13	0.1295	0.3235	0.16	0.705	1.44	0.223	74	-0.2872	0.1252	5.26	0.241
SEA RAVEN	1	13	0.1295	0.3235	0.16	0.718	1.79	0.442	72	-0.2598	0.1091	5.68	**0.017**
ALLIGATORFISH	0	40	-0.1174	0.1561	0.57	0.546	0.52	0.620	94	-0.1742	0.1084	2.58	0.170
ARCTIC ALLIGATORFISI	0	28	-0.6934	0.2916	5.65	0.082	-	-	28	-0.6934	0.2916	5.65	0.078
ATL SEA POACHER	0	37	-0.0903	0.1492	0.37	0.522	11.65	**0.013**					
THREESPINE STICKLEBACK	0	13	0.8892	0.3315	7.19	0.363	-	-	13	0.8892	0.3315	7.19	0.363
MARLIN-SPIKE GRENADIER	0	7					0.73	0.632	23	-0.2480	0.1779	1.94	0.304
ATL SPINY LUMPSUCKER	0	25	0.1057	0.2264	0.22	0.660	1.59	0.335	51	0.2493	0.1772	1.98	0.222
DUSKY SEASNAIL	0	41	-0.0598	0.1551	0.15	0.878	0.91	0.673	50	-0.0396	0.1442	0.08	0.932
NORTHERN SAND LANC	0	11	-2.2125	0.6442	11.80	0.087	132.4	0.286	54	1.0711	0.2815	14.48	**0.012**
NORTHERN SAND LANC	1	11					5.84	0.090	47	0.7419	0.1752	17.94	**0.036**
FISH DOCTOR	0	15	0.7099	0.4454	2.54	0.285	-	-					
LAVAL`S EELPOUT	0	48	0.3000	0.1387	4.68	0.077	-	-					
SNAKEBLENNY	0	20	0.4840	0.2517	3.70	0.094	2.47	0.320	45	0.7121	0.1626	19.18	**0.002**
DAUBED SHANNY	0	69	-0.4214	0.0700	36.26	**0.001**	195.3	**0.001**					
4-LINE SNAKE BLENNY	0	27	0.3846	0.2027	3.60	0.257	-	-					
STOUT EELBLENNY	0	30	0.2024	0.1099	3.39	0.102	-	-					
OCEAN POUT(COMMON	0	8					5.47	0.089	37	-0.4094	0.1826	5.02	0.107

Species	outlier	DF	1. September survey data only				2. Survey effect		3. September & July data				
			β_v	SE	χ^2	*P*	χ^2	*P*	DF	β_v	SE	χ^2	*P*
VAHL'S EELPOUT	0	17	0.4203	0.2281	3.40	0.325	4.65	0.076	48	0.5284	0.1415	13.94	**0.023**
VAHL'S EELPOUT	1	16	0.0718	0.1556	0.21	0.718	1.66	0.632	47	0.3892	0.1285	9.17	**0.016**
WHITE BARRACUDINA	0	6					0.02	0.959	18	-0.1363	0.2759	0.24	0.698
ATL. HOOKEAR SCULPI	0	36	-0.3321	0.2272	2.14	0.314	20.20	0.203	60	-0.5927	0.1888	9.86	**0.048**
ATL ROCK CRAB	0	16	-0.0673	0.1538	0.19	0.571	11.49	**0.038**					
HYAS COARCTATUS	0	73	-0.0030	0.1205	0.00	0.973	19.18	**0.002**					
HYAS COARCTATUS	1	72	-0.0843	0.1129	0.56	0.553	17.16	0.285	130	0.2086	0.0858	5.91	0.119
NORTHERN STONE CRA	0	10	0.9883	0.5948	2.76	0.129	2.08	0.250	42	0.5571	0.2094	7.08	**0.017**
SNOW CRAB	0	91	-0.0867	0.0770	1.27	0.373	29.19	**0.001**					
SNOW CRAB	1	89	-0.2022	0.0674	9.01	**0.018**	201.12	**0.012**					
TOAD CRAB	0	48	-0.6583	0.2144	9.43	**0.012**	62.41	**0.021**					
SHORT-FIN SQUID	0	24	0.0674	0.2067	0.11	0.741	0.27	0.926	131	0.1573	0.1102	2.04	0.564
SHORT-FIN SQUID	1	24					0.00	0.993	130	0.0584	0.1019	0.33	0.786

Table 4. Results of mixed effects model analyses of length-aggregated data, with set pairs having ≥20% difference in tow distance removed, testing for (1) a difference in catchability between the *CCGS Alfred Needler* and the *CCGS Teleost* based on the September 2004 and 2005 comparative fishing experiments, (2) an interaction between the vessel and survey effect and (3) a difference in catchability based on the combined September and July comparative fishing experiments, where appropriate. The column *outlier* indicates whether outliers were included (value=0) or excluded (=1) from the analysis. *P* is the probability value for the *t*-statistic.

		1. September survey data only					2. Survey effect		3.September & July data where appropriate				
Species	**outlier**	**DF**	β_v	**SE**	t	P	t	P	**DF**	β_v	**SE**	t	P
ATL. COD	0	80	0.0944	0.0827	1.142	0.2570	0.729	0.4670	185	0.0448	0.0798	0.562	0.5746
ATL. COD	1	79	0.1321	0.0748	1.766	0.0812	0.361	0.7188	182	0.1074	0.0687	1.563	0.1198
WHITE HAKE	0	20	0.2792	0.0972	2.873	**0.0094**	0.135	0.8931	34	0.2708	0.0833	3.251	**0.0026**
REDFISH (SEBASTES SP.)	0	23	-0.1128	0.1492	-0.756	0.4574	-0.894	0.3728	141	0.0994	0.1185	0.839	0.4031
REDFISH (SEBASTES SP.)	1	23					-0.882	0.3793	132	0.0429	0.0968	0.444	0.6581
ATLANTIC HALIBUT	0	10	0.5554	0.3986	1.393	0.1938	0.628	0.5332	49	0.0901	0.2206	0.409	0.6847
GREENLAND HALIBUT	0	37	0.1999	0.1767	1.131	0.2652	0.826	0.4118	69	0.0961	0.1236	0.777	0.4398
AMERICAN PLAICE	0	89	0.1642	0.0478	3.436	**0.0009**	1.475	0.1417	228	0.1087	0.0444	2.450	**0.0150**
AMERICAN PLAICE	1	89					1.126	0.2615	227	0.1254	0.0421	2.982	**0.0032**
WITCH FLOUNDER	0	23	0.2891	0.2198	1.316	0.2013	1.618	0.1082	120	0.0281	0.0904	0.311	0.7566
WITCH FLOUNDER	1	22	0.1498	0.1796	0.834	0.4133	0.945	0.3466	119	0.0032	0.0834	0.039	0.9693
YELLOWTAIL FLOUNDER	0	36	0.0887	0.1519	0.584	0.5630	0.202	0.8403	107	0.0693	0.0801	0.865	0.3888
WINTER FLOUNDER	0	18	0.2383	0.2536	0.940	0.3597	0.086	0.9321	48	0.2391	0.1508	1.586	0.1193
WINTER FLOUNDER	1	16	0.2251	0.2552	0.882	0.3909	0.034	0.9734	46	0.2339	0.1479	1.581	0.1207
STRIPED ATL WOLFFISH	0	5	0.7576	0.9949	0.761	0.4807	0.734	0.4667	49	0.0688	0.2390	0.288	0.7745
ATL. HERRING	0	55	0.5431	0.2722	1.995	0.0510	1.445	0.1506	155	0.2686	0.1438	1.867	0.0637
ATL. HERRING	1	49	0.4179	0.1658	2.520	**0.0150**	1.001	0.3186	149	0.1900	0.1225	1.551	0.1230
GASPEREAU	0	6	-1.5132	0.9643	-1.569	0.1676	-1.998	0.0537	35	-0.6099	0.2760	-2.210	**0.0337**
RAINBOW SMELT	0	8											
CAPELIN	0	58	0.1140	0.1605	0.710	0.4804	-1.204	0.2318	86	0.2313	0.1574	1.469	0.1454
CAPELIN	1	58					-2.094	**0.0394**					
ATL. MACKEREL	0	17	-0.8828	0.8795	-1.004	0.3295	-0.306	0.7622	23	-0.7248	0.6711	-1.080	0.2913
ARCTIC COD	0	6											
LONGFIN HAKE	0	4					-1.096	0.2826	28	0.4212	0.3610	1.167	0.2531
FOURBEARD ROCKLING	0	17	0.1573	0.3229	0.487	0.6325	-0.578	0.5664	41	0.2715	0.2146	1.265	0.2129

		1. September survey data only					2. Survey effect		3.September & July data where appropriate				
Species	**outlier**	**DF**	β_v	**SE**	t	P	t	P	**DF**	β_v	**SE**	t	P
GREENLAND COD	0	25	0.8985	0.3327	2.700	**0.0122**							
THORNY SKATE	0	21	0.1726	0.1776	0.972	0.3422	0.239	0.8115	98	0.1345	0.0957	1.406	0.1629
SMOOTH SKATE	0	10	-0.1103	0.2430	-0.454	0.6596	-0.709	0.4822	47	0.0710	0.1793	0.396	0.6939
WINTER SKATE	0	5					-0.187	0.8545	16	-0.1013	0.4973	-0.204	0.8412
ATLANTIC HAGFISH	0	11	0.0145	0.3794	0.038	0.9703	-1.031	0.3085	41	0.4167	0.2674	1.558	0.1268
LONGHORN SCULPIN	0	18	0.8736	0.3081	2.836	**0.0110**	3.624	**0.0005**					
SHORTHORN SCULPIN	0	30	-0.0042	0.2887	-0.015	0.9884	-0.303	0.7638	37	0.0292	0.2613	0.112	0.9117
SHORTHORN SCULPIN	1	29	-0.2186	0.2047	-1.068	0.2944	-0.646	0.5226	36	-0.1734	0.1918	-0.904	0.3719
ARCTIC STAGHORN SCULPIN	0	31	0.1116	0.2766	0.403	0.6894							
ARCTIC STAGHORN SCULPIN	1	30	-0.0009	0.2593	-0.003	0.9973							
MOUSTACHE SCULPIN	0	49	0.4433	0.1736	2.553	**0.0138**	1.097	0.2754	100	0.3159	0.1318	2.397	**0.0184**
ARCTIC HOOKEAR SCULPIN	0	20	-0.4776	0.6503	-0.734	0.4712			21	-0.3651	0.6272	-0.582	0.5667
SPATULATE SCULPIN	0	38	-0.1032	0.2559	-0.403	0.6890			41	0.0061	0.2525	0.024	0.9808
SEA RAVEN	0	12	0.0625	0.3647	0.171	0.8668	0.728	0.4693	71	-0.2818	0.1577	-1.787	0.0782
SEA RAVEN	1	12					1.095	0.2772	69	-0.2718	0.1126	-2.414	**0.0184**
ALLIGATORFISH	0	38	-0.0292	0.2052	-0.142	0.8878	0.361	0.7191	91	-0.0832	0.1405	-0.592	0.5551
ARCTIC ALLIGATORFISH	0	26	-0.5091	0.5032	-1.012	0.3210							
ATL SEA POACHER	0	36	-0.1093	0.1721	-0.635	0.5294	-2.439	**0.0178**					
THREESPINE STICKLEBACK	0	13	0.3315	0.6158	0.538	0.5994							
MARLIN-SPIKE GRENADIER	0	7					-0.577	0.5700	22	-0.3199	0.2307	-1.387	0.1794
ATL SPINY LUMPSUCKER	0	23	0.1898	0.2804	0.677	0.5051	-0.986	0.3294	48	0.3701	0.2142	1.728	0.0904
DUSKY SEASNAIL	0	38	0.1277	0.2455	0.520	0.6060	-0.613	0.5428	47	0.1816	0.2237	0.812	0.4210
NORTHERN SAND LANCE	0	10	-0.8689	0.6811	-1.276	0.2309	-1.502	0.1392	52	0.6013	0.4169	1.442	0.1552
NORTHERN SAND LANCE	1	10					-1.709	0.0943	46	0.3517	0.3348	1.051	0.2990
FISH DOCTOR	0	12	0.5059	0.6919	0.731	0.4787							
LAVAL`S EELPOUT	0	43	0.3083	0.1865	1.653	0.1055							

Species	outlier	1. September survey data only DF	β_v	SE	t	P	2. Survey effect t	P	3.September & July data where appropriate DF	β_v	SE	t	P
SNAKEBLENNY	0	20	0.7239	0.3368	2.150	**0.0440**	0.120	0.9047	43	0.6715	0.2074	3.238	**0.0023**
DAUBED SHANNY	0	65	-0.2845	0.1095	-2.599	**0.0116**	-3.416	**0.0009**					
4-LINE SNAKE BLENNY	0	24	-0.0624	0.3978	-0.157	0.8766							
STOUT EELBLENNY	0	28	0.1825	0.2788	0.655	0.5181							
OCEAN POUT(COMMON)	0	8					1.801	0.0803	36	-0.1814	0.2355	-0.770	0.4462
VAHL'S EELPOUT	0	17	0.1913	0.3218	0.594	0.5601	-0.514	0.6101	45	0.3211	0.1961	1.637	0.1085
VAHL'S EELPOUT	1	16	-0.0089	0.1817	-0.049	0.9615	-1.403	0.1679	44	0.2539	0.1740	1.460	0.1515
WHITE BARRACUDINA	0	6					0.553	0.5876	18	-0.3547	0.5724	-0.620	0.5432
ATL. HOOKEAR SCULPIN	0	32	-0.6678	0.3449	-1.936	0.0617	1.388	0.1708	55	-0.9789	0.2979	-3.286	**0.0018**
ATL. HOOKEAR SCULPIN	1	30	-0.8841	0.3346	-2.642	**0.0130**	1.049	0.2991	53	-1.1286	0.2938	-3.841	**0.0003**
ATL ROCK CRAB	0	15	-0.0599	0.1384	-0.432	0.6716	1.993	0.0541	36	-0.6354	0.2466	-2.577	**0.0142**
HYAS COARCTATUS	0	67	-0.1829	0.2001	-0.914	0.3642	-2.317	**0.0222**					
HYAS COARCTATUS	1	66	-0.2608	0.1801	-1.448	0.1524	-3.837	**0.0002**					
NORTHERN STONE CRAB	0	10	1.4003	0.8290	1.689	0.1221	1.177	0.2462	40	0.6218	0.2370	2.624	**0.0122**
SNOW CRAB	0	84	-0.1033	0.0840	-1.231	0.2219	-5.079	**0.0000**					
SNOW CRAB	1	82	-0.1525	0.0792	-1.926	0.0576	-5.517	**0.0000**					
TOAD CRAB	0	43	-1.3664	0.3489	-3.917	**0.0003**	-2.182	**0.0319**					
SHORT-FIN SQUID	0	23	0.2175	0.2588	0.840	0.4093	0.917	0.3607	128	0.0152	0.1564	0.097	0.9225
SHORT-FIN SQUID	1	23					0.986	0.3261	127	-0.0092	0.1563	-0.059	0.9530

Table 5. Results of mixed effects model analyses of length-aggregated data (all relevant set pairs) testing for (1) a difference in catchability between the *CCGS Alfred Needler* and the *CCGS Teleost* based on the September 2004 and 2005 comparative fishing experiments, (2) an interaction between the vessel and survey effect and (3) a difference in catchability based on the combined September and July comparative fishing experiments, where appropriate. The column *outlier* indicates whether outliers were included (value=0) or excluded (=1) from the analysis. *P* is the probability value for the *t*-statistic.

		1. September survey data only					**2. Survey effect**		**3.September & July data where appropriate**				
Species	**outlier**	**DF**	β_v	**SE**	t	P	t	P	**DF**	β_v	**SE**	t	P
ATL. COD	0	86	0.1544	0.0867	1.78	0.079	0.69	0.491	195	0.1035	0.0822	1.26	0.210
ATL. COD	1	85	0.1878	0.0815	2.31	**0.024**	0.31	0.757	192	0.1640	0.0743	2.21	**0.029**
WHITE HAKE	0	20	0.2792	0.0972	2.87	**0.009**	-0.19	0.851	35	0.2891	0.0790	3.66	**0.001**
REDFISH (SEBASTES SP.)	0	24	-0.1283	0.1491	-0.86	0.398	-1.04	0.299	146	0.0981	0.1168	0.84	0.402
REDFISH (SEBASTES SP.)	1	24					-1.04	0.298	137	0.0487	0.0963	0.51	0.614
ATLANTIC HALIBUT	0	10	0.5554	0.3986	1.39	0.194	0.63	0.533	49	0.0901	0.2206	0.41	0.685
GREENLAND HALIBUT	0	38	0.2095	0.1761	1.19	0.242	1.40	0.167	72	0.0295	0.1358	0.22	0.828
AMERICAN PLAICE	0	95	0.1681	0.0453	3.71	**<0.001**	1.43	0.153	238	0.1166	0.0427	2.73	**0.007**
AMERICAN PLAICE	1	95					1.08	0.281	237	0.1326	0.0404	3.28	**0.001**
WITCH FLOUNDER	0	23	0.2891	0.2198	1.32	0.201	1.65	0.101	123	0.0244	0.0883	0.28	0.783
WITCH FLOUNDER	1	22	0.1498	0.1796	0.83	0.413	0.97	0.333	122	-0.0002	0.0815	0.00	0.998
YELLOWTAIL FLOUNDER	0	40	0.1008	0.1339	0.75	0.456	0.19	0.847	113	0.0808	0.0773	1.05	0.298
WINTER FLOUNDER	0	19	0.2126	0.2424	0.88	0.391	0.19	0.851	51	0.1993	0.1420	1.40	0.166
WINTER FLOUNDER	1	17	0.1973	0.2424	0.81	0.427	0.13	0.899	49	0.1923	0.1387	1.39	0.172
STRIPED ATL WOLFFISH	0	5					0.68	0.498	50	0.1130	0.2391	0.47	0.639
ATL. HERRING	0	59	0.5740	0.2640	2.17	**0.034**	1.58	0.116	162	0.2708	0.1418	1.91	0.058
ATL. HERRING	1	53	0.4248	0.1645	2.58	**0.013**	1.16	0.250	156	0.1929	0.1216	1.59	0.115
GASPEREAU	0	6	-1.5132	0.9643	-1.57	0.168	-1.96	0.058	36	-0.6345	0.2739	-2.32	**0.026**
RAINBOW SMELT	0	8	0.4500	0.4178	1.08	0.313							
CAPELIN	0	60	0.0155	0.1820	0.09	0.932	-1.46	0.147	89	0.1693	0.1650	1.03	0.308
CAPELIN	1	60					-2.22	**0.029**	90				
ATL. MACKEREL	0	20	-0.5150	0.8028	-0.64	0.528	-0.30	0.770	27	-0.3837	0.6136	-0.63	0.537
LONGFIN HAKE	0	4					-1.08	0.288	29	0.3957	0.3492	1.13	0.266
FOURBEARD ROCKLING	0	18	0.1180	0.3168	0.37	0.714	-0.80	0.427	44	0.2830	0.2090	1.35	0.183
GREENLAND COD	0	28	0.7283	0.2624	2.78	**0.010**							

		1. September survey data only					2. Survey effect		3.September & July data where appropriate				
Species	outlier	DF	β_v	SE	t	P	t	P	DF	β_v	SE	t	P
THORNY SKATE	0	21	0.1726	0.1776	0.97	0.342	0.21	0.832	100	0.1391	0.0950	1.46	0.146
SMOOTH SKATE	0	10	-0.1103	0.2430	-0.45	0.660	-0.58	0.566	49	0.0441	0.1813	0.24	0.809
WINTER SKATE	0	5					-0.19	0.855	16	-0.1013	0.4973	-0.20	0.841
ATLANTIC HAGFISH	0	11	0.0145	0.3794	0.04	0.970	-0.93	0.359	42	0.3800	0.2659	1.43	0.160
LONGHORN SCULPIN	0	20	0.8395	0.3025	2.78	**0.012**	3.68	**<0.001**					
SHORTHORN SCULPIN	0	32	-0.0138	0.2830	-0.05	0.962	-0.32	0.753	39	0.0202	0.2570	0.08	0.938
SHORTHORN SCULPIN	1	31	-0.2200	0.2024	-1.09	0.285	-0.65	0.520	38	-0.1755	0.1899	-0.92	0.361
ARCTIC STAGHORN SCULPIN	0	36	0.0017	0.2719	0.01	0.995							
ARCTIC STAGHORN SCULPIN	1	35	-0.0994	0.2635	-0.38	0.708							
MOUSTACHE SCULPIN	0	51	0.3863	0.1658	2.33	**0.024**	0.91	0.367	103	0.2900	0.1273	2.28	**0.025**
ARCTIC HOOKEAR SCULPIN	0	22	-0.4379	0.5880	-0.74	0.464							
SPATULATE SCULPIN	0	41	-0.2700	0.2644	-1.02	0.313							
SEA RAVEN	0	13	0.1143	0.3558	0.32	0.753	0.89	0.377	74	-0.2682	0.1525	-1.76	0.083
SEA RAVEN	1	13	0.1143	0.3558	0.32	0.753	1.24	0.218	72	-0.2631	0.1077	-2.44	**0.017**
ALLIGATORFISH	0	40	-0.1114	0.1971	-0.57	0.575	-0.02	0.983	94	-0.1099	0.1370	-0.80	0.424
ARCTIC ALLIGATORFISH	0	28	-0.4239	0.5006	-0.85	0.404							
ATL SEA POACHER	0	37	-0.0979	0.1711	-0.57	0.571	-2.51	**0.015**					
THREESPINE STICKLEBACK	0	13	0.3315	0.6158	0.54	0.599							
MARLIN-SPIKE GRENADIER	0	7					-0.67	0.509	23	-0.2883	0.2072	-1.39	0.177
ATL SPINY LUMPSUCKER	0	25	0.1947	0.2604	0.75	0.462	-0.83	0.410	51	0.3389	0.2039	1.66	0.103
DUSKY SEASNAIL	0	41	0.0726	0.2229	0.33	0.746	-0.70	0.489	50	0.1235	0.2058	0.60	0.551
NORTHERN SAND LANCE	0	11	-0.9839	0.6481	-1.52	0.157	-1.69	0.097	53	0.5561	0.4132	1.35	0.184
NORTHERN SAND LANCE	1	11					-1.90	0.064	47	0.3140	0.3323	0.95	0.349
FISH DOCTOR	0	15	0.4586	0.5894	0.78	0.449							
LAVAL`S EELPOUT	0	48	0.3520	0.1738	2.03	**0.048**							
SNAKEBLENNY	0	20	0.7239	0.3368	2.15	**0.044**	0.10	0.919	44	0.6692	0.2022	3.31	**0.002**

		1. September survey data only					2. Survey effect		3.September & July data where appropriate				
Species	**outlier**	**DF**	β_v	**SE**	t	P	t	P	**DF**	β_v	**SE**	t	P
DAUBED SHANNY	0	69	-0.3154	0.1173	-2.69	**0.009**	-3.60	**0.001**					
4-LINE SNAKE BLENNY	0	27	0.0478	0.3456	0.14	0.891			27	0.0478	0.3456	0.14	0.891
STOUT EELBLENNY	0	30	0.2621	0.2770	0.95	0.352							
OCEAN POUT(COMMON)	0	8					1.86	0.071	37	-0.2074	0.2218	-0.94	0.356
VAHL'S EELPOUT	0	17	0.1913	0.3218	0.59	0.560	-0.61	0.543	47	0.3466	0.1887	1.84	0.073
VAHL'S EELPOUT	1	16	-0.0089	0.1817	-0.05	0.962	-1.53	0.133	46	0.2811	0.1679	1.67	0.101
WHITE BARRACUDINA	0	6					0.55	0.588	18	-0.3547	0.5724	-0.62	0.543
ATL. HOOKEAR SCULPIN	0	36	-0.8419	0.3269	-2.58	**0.014**	1.22	0.229	60	-1.0963	0.2841	-3.86	**<0.001**
ATL. HOOKEAR SCULPIN	1	34	-1.0437	0.3125	-3.34	**0.002**	0.88	0.383	58	-1.2382	0.2781	-4.45	**<0.001**
ATL ROCK CRAB	0	16	-0.0732	0.1430	-0.51	0.616	1.83	0.075	38	-0.6175	0.2373	-2.60	**0.013**
Hyas coarctatus	0	73	-0.2419	0.1942	-1.25	0.217	-2.50	**0.014**					
Hyas coarctatus	1	72	-0.3093	0.1776	-1.74	0.086	-3.95	**<0.001**					
NORTHERN STONE CRAB	0	10	1.4003	0.8290	1.69	0.122	1.25	0.220	41	0.5913	0.2258	2.62	**0.012**
SNOW CRAB	0	91	-0.1521	0.0857	-1.78	0.079	-5.24	**<0.001**					
SNOW CRAB	1	89	-0.1976	0.0815	-2.42	**0.017**	-5.66	**<0.001**					
Hyas araneus	0	48	-1.1424	0.3017	-3.79	**<0.001**	-2.01	**0.047**					
SHORT-FIN SQUID	0	24	0.1957	0.2495	0.78	0.440	0.81	0.420	131	0.0349	0.1533	0.23	0.820
SHORT-FIN SQUID	1	24					0.88	0.382	130	0.0111	0.1532	0.07	0.943

Table 6. Results of fixed effects model analyses, with set pairs having ≥20% difference in tow distance removed, testing for (1) a length-dependent difference in catchability between the *CCGS Alfred Needler* and the *CCGS Teleost* based on the September 2004 and 2005 comparative fishing experiments, (2) an interaction between the length and survey effect and (3) a length-dependent difference in catchability based on the combined September and July comparative fishing experiments, where appropriate. The column *outlier* indicates whether outliers were included (value=0) or excluded (=1) from the analysis. Probability values are based on 999 permutations under the null hypothesis.

			length effect FIXED - September				Survey effect		length effect FIXED - September & July				
Species	**outlier**	**DF**	β_{length}	**SE**	χ^2	*P*	**Deviance**	*P*	**DF**	β_{length}	**SE**	χ^2	*P*
ATL. COD	0	1224	0.0051	0.0027	3.64	0.3160	4001.4	**0.0010**					
ATL. COD	1	1154	0.0022	0.0026	0.73	0.3890	3493.5	**0.0010**					
WHITE HAKE	0	306	-0.0045	0.0079	0.33	0.6120	581.3	0.1690	424	-0.0063	0.0062	1.03	0.5000
REDFISH (SEBASTES SP.)	0	213	-0.0043	0.0076	0.32	0.7970	7007.5	0.2970	1443	0.0035	0.0034	1.06	0.3480
REDFISH (SEBASTES SP.)	1	213					5836.4	0.5630	1394	-0.0009	0.0031	0.08	0.8270
HALIBUT(ATLANTIC)	0	24							145	-0.0025	0.0064	0.15	0.3100
GREENLAND HALIBUT	0	280	-0.0094	0.0057	2.74	0.3540	1160.0	**0.0090**					
GREENLAND HALIBUT	1	280					1160.0	**0.0140**					
AMERICAN PLAICE	0	1977	-0.0058	0.0030	3.73	0.1240	6596.0	0.2520	3832	-0.0119	0.0022	29.37	**0.0010**
AMERICAN PLAICE	1	1977					6310.8	**0.0030**					
WITCH FLOUNDER	0	253	-0.0037	0.0150	0.06	0.7970	1636.0	**0.0460**					
WITCH FLOUNDER	1	215	-0.0096	0.0144	0.44	0.5030	1474.3	**0.0050**					
YELLOWTAIL FLOUNDER	0	347	-0.0261	0.0100	6.75	0.2780	1913.1	0.3780	1067	-0.0089	0.0049	3.21	0.6800
YELLOWTAIL FLOUNDER	1	302	-0.0054	0.0109	0.24	0.7910	1637.9	0.3330	980	-0.0038	0.0051	0.54	0.8670
WINTER FLOUNDER	0	254	-0.0101	0.0107	0.89	0.6910	1038.9	0.2100	487	-0.0182	0.0073	6.18	0.4440
WINTER FLOUNDER	1	182	0.0393	0.0097	16.49	**0.0100**	675.2	**0.0160**					
STRIPED ATL WOLFFISH	0	4							138	0.0083	0.0079	1.12	0.3560
ATL. HERRING	0	592	0.0442	0.0232	3.64	0.1250	6759.9	**0.0010**					
ATL. HERRING	1	493	0.0282	0.0098	8.28	**0.0020**	3853.9	**0.0010**					
GASPEREAU	0	27	0.2495	0.2339	1.14	0.0520	297.1	**0.0020**					
RAINBOW SMELT	0	66	-0.1147	0.0773	2.20	0.2610							
CAPELIN	0	311	0.0954	0.0260	13.47	**0.0480**	3306.3	0.7780	429	-0.0510	0.0417	1.50	0.4640
CAPELIN	1	311					2234.2	0.3260	411	0.0566	0.0356	2.52	0.2040

		length effect FIXED - September					Survey effect		length effect FIXED - September & July				
Species	**outlier**	**DF**	β_{length}	**SE**	χ^2	***P***	**Deviance**	***P***	**DF**	β_{length}	**SE**	χ^2	***P***
ATL. MACKEREL	0	42	-0.3207	0.0953	11.32	0.6130	97.8	**0.0040**					
LONGFIN HAKE	0	29							200	0.0025	0.0211	0.01	0.9460
FOURBEARD ROCKLING	0	77	0.0022	0.0351	0.00	0.9580	191.3	0.2240	140	-0.0089	0.0298	0.09	0.7430
FOURBEARD ROCKLING	1	60	0.0260	0.0418	0.39	0.4770	167.1	0.9470	123	-0.0024	0.0339	0.00	0.9330
GREENLAND COD	0	42	-0.1001	0.0429	5.45	**0.0060**							
THORNY SKATE	0	156	0.0059	0.0088	0.45	0.5390	777.1	0.3440	561	0.0064	0.0045	2.07	0.8370
SMOOTH SKATE	0	57	0.0292	0.0191	2.33	0.1290	237.5	0.9630	165	0.0095	0.0108	0.78	0.4430
SMOOTH SKATE	1	57					206.3	0.4860	146	0.0078	0.0109	0.51	0.4710
WINTER SKATE	0	22							39	-0.0091	0.0164	0.31	0.9120
ATLANTIC HAGFISH	0	38	-0.0450	0.0588	0.58	0.8030	183.7	**0.0160**					
LONGHORN SCULPIN	0	88	-0.0733	0.0374	3.84	0.0640	963.9	**0.0010**					
LONGHORN SCULPIN	1	61	-0.0394	0.0442	0.79	0.4000	914.4	**0.0010**					
SHORTHORN SCULPIN	0	95	0.0134	0.0258	0.27	0.7440	153.8	0.9240	108	0.0111	0.0244	0.21	0.8180
SHORTHORN SCULPIN	1	83	0.0345	0.0290	1.41	0.1430	133.5	0.6650	96	0.0294	0.0270	1.19	0.2380
ARCTIC STAGHORN SCULPIN	0	79	-0.0656	0.0423	2.40	0.5600							
MOUSTACHE SCULPIN	0	219	0.0591	0.0359	2.70	0.1150	726.2	0.2750	399	0.0873	0.0289	9.13	**0.0240**
ARCTIC HOOKEAR SCULPIN	0	32.	0.9451	0.5784	2.67	0.8720	99.5	0.5550	33	0.8515	0.5428	2.46	0.8880
SPATULATE SCULPIN	0	120	0.0667	0.0588	1.29	0.1880	200.1	**0.0420**					
SEA RAVEN	0	34	0.0296	0.0420	0.50	0.4410	498.0	0.2760	325	-0.0331	0.0098	11.29	0.3050
SEA RAVEN	1	34					424.0	0.2420	291	-0.0041	0.0117	0.12	0.8810
ALLIGATORFISH	0	122	0.0594	0.0612	0.94	0.4170	372.4	0.7400	258	0.1760	0.0416	17.89	**0.0020**
ARCTIC ALLIGATORFISH	0	69	-0.1939	0.2394	0.66	0.7650			69	-0.1939	0.2394	0.66	0.7810
ATL SEA POACHER	0	142	0.0610	0.0281	4.71	0.1880	360.8	**0.0030**					
MARLIN-SPIKE GRENADIER	0	60	0.0538	0.0346	2.42	0.1350	190.7	0.6830	123	0.0275	0.0219	1.58	0.1750
ATL SPINY LUMPSUCKER	0	69	-0.0168	0.1137	0.02	0.8570	172.5	0.1890	117	-0.0320	0.0890	0.13	0.6660
DUSKY SEASNAIL	0	135	0.0079	0.0243	0.10	0.7310	235.8	0.2340	146	0.0181	0.0230	0.62	0.3100
FISH DOCTOR	0	36	0.1383	0.1694	0.67	0.3690	83.8	0.7050	37	0.1146	0.1638	0.49	0.5020
LAVAL`S EELPOUT	0	243	0.0000	0.0076	0.00	0.9930	340.8	0.1060	247	0.0022	0.0075	0.09	0.7400
LAVAL`S EELPOUT	1	229	0.0041	0.0076	0.29	0.6010	317.3	0.0930	233	0.0064	0.0075	0.71	0.5570

		length effect FIXED - September					Survey effect		length effect FIXED - September & July				
Species	**outlier**	**DF**	β_{length}	**SE**	χ^2	***P***	**Deviance**	***P***	**DF**	β_{length}	**SE**	χ^2	***P***
SNAKEBLENNY	0	96	-0.0057	0.0269	0.04	0.8120	345.9	0.2580	241	0.0268	0.0155	3.01	0.1100
DAUBED SHANNY	0	298	0.1868	0.0317	34.84	**0.0010**	1083.0	**0.0010**					
4-LINE SNAKE BLENNY	0	151	-0.1150	0.0426	7.28	0.1810							
STOUT EELBLENNY	0	137	0.0641	0.0376	2.91	0.1580							
OCEAN POUT(COMMON)	1	20	-0.0360	0.0411	0.77	0.2670	172.9	0.0730	127	-0.0251	0.0141	3.18	0.5020
VAHL'S EELPOUT	0	137	0.0319	0.0136	5.47	0.2900	534.4	0.8150	348	0.0064	0.0092	0.48	0.5370
VAHL'S EELPOUT	1	94	0.0105	0.0170	0.38	0.5990	444.5	0.1080	305	-0.0022	0.0097	0.05	0.7900
WHITE BARRACUDINA	0	17	0.1914	0.1977	0.94	0.3710	242.5	0.9230	72	-0.0827	0.0586	1.99	0.5250
ATL. HOOKEAR SCULPIN	0	76	-0.0019	0.1776	0.00	0.9900	220.3	0.0850	122	-0.1083	0.1290	0.70	0.4620
ATL ROCK CRAB	0	144	0.0048	0.0058	0.68	0.5080	311.9	**0.0020**					
Hyas coarctatus	0	770	0.0025	0.0035	0.52	0.3970	2015.9	**0.0060**					
Hyas coarctatus	1	740	0.0022	0.0035	0.39	0.4480	1934.1	**0.0010**					
NORTHERN STONE CRAB	0	37	0.0208	0.0158	1.73	0.3900	165.5	0.1180	130	0.0114	0.0074	2.34	0.1160
SNOW CRAB	0	3241	-0.0010	0.0011	0.81	0.8420	9210.4	**0.0010**					
Hyas araneus	0	152	0.0246	0.0083	8.71	**0.0280**	524.0	**0.0010**					
Hyas araneus	1	138	0.0313	0.0098	10.10	**0.0470**	501.3	**0.0010**					
SHORT-FIN SQUID	0	61	0.1698	0.1163	2.13	0.2070	1476.7	0.5190	457	-0.0611	0.0232	6.96	0.1920

Table 7. Results of fixed effects model analyses (all relevant set pairs) testing for (1) a length-dependent difference in catchability between the *CCGS Alfred Needler* and the *CCGS Teleost* based on the September 2004 and 2005 comparative fishing experiments, (2) an interaction between the length and survey effect and (3) a length-dependent difference in catchability based on the combined September and July comparative fishing experiments, where appropriate. The column *outlier* indicates whether outliers were included (value=0) or excluded (=1) from the analysis. Probability values are based on 999 permutations under the null hypothesis.

			1. September survey data only				2. Survey effect		3.September & July data where appropriate				
Species	**outlier**	**DF**	β_{length}	**SE**	χ^2	P	**Deviance**	P	**DF**	β_{length}	**SE**	χ^2	P
ATL. COD	0	1324	0.0031	0.0026	1.46	0.452	4445.3	**0.010**					
ATL. COD	1	1254	0.0001	0.0025	0.00	0.947	3911.3	**0.001**					
WHITE HAKE	0	306	-0.0045	0.0079	0.33	0.586	643.2	1.000	460	-0.0083	0.0058	2.09	0.258
REDFISH (SEBASTES SP.)	0	214	-0.0041	0.0076	0.30	0.789	7170.8	0.240	1515	0.0023	0.0033	0.46	0.547
REDFISH (SEBASTES SP.)	1	214	-0.0041	0.0076	0.30	0.819	5999.0	0.543	1466	-0.0021	0.0030	0.49	0.578
ATLANTIC HALIBUT	0	24					197.5	0.380	145	-0.0025	0.0064	0.15	0.313
GREENLAND HALIBUT	0	281	-0.0096	0.0057	2.88	0.385	1339.9	0.360	669	-0.0059	0.0042	1.97	0.187
GREENLAND HALIBUT	1	281					1165.0	**0.009**					
AMERICAN PLAICE	0	2100	-0.0057	0.0029	3.79	0.115	6888.3	0.420	4000	-0.0123	0.0022	32.4	**0.001**
AMERICAN PLAICE	1	2100					6605.0	**0.028**					
WITCH FLOUNDER	0	253	-0.0037	0.0150	0.06	0.802	1668.1	**0.040**					
WITCH FLOUNDER	1	215	-0.0096	0.0144	0.44	0.507	1506.5	**0.010**					
YELLOWTAIL FLOUNDER	0	377	-0.0255	0.0097	7.00	0.242	1960.2	0.400	1103	-0.0087	0.0049	3.24	0.682
YELLOWTAIL FLOUNDER	1	332	-0.0065	0.0104	0.39	0.740	1684.8	0.378	1016	-0.0038	0.0050	0.56	0.873
WINTER FLOUNDER	0	262	-0.0103	0.0106	0.95	0.691	1102.2	0.061	524	-0.0181	0.0071	6.61	0.497
WINTER FLOUNDER	1	190	0.0389	0.0096	16.2	**0.008**	729.5	**0.002**					
STRIPED ATL WOLFFISH	0	4					198.5	0.580	139	0.0064	0.0078	0.68	0.330
ATL. HERRING	0	606	0.0439	0.0229	3.66	0.104	6808.6	**0.010**					
ATL. HERRING	1	507	0.0279	0.0098	8.12	**0.001**	3900.6	**0.001**					
CAPELIN	0	322	0.1222	0.0253	23.4	**0.027**	3471.8	0.710	445	-0.0133	0.0394	0.11	0.816
CAPELIN	1	322					2351.0	0.354	427	0.0861	0.0339	6.46	**0.043**
ATL. MACKEREL	0	47	-0.3066	0.0825	13.8	0.283	115.4	**0.010**					
LONGFIN HAKE	0	29					414.4	0.120	202	0.0023	0.0211	0.01	0.942
FOURBEARD ROCKLING	0	78	0.0023	0.0350	0.00	0.956	198.2	0.200	147	-0.0120	0.0293	0.17	0.673
FOURBEARD ROCKLING	1	61	0.0264	0.0416	0.40	0.446	174.2	0.904	130	-0.0065	0.0333	0.04	0.784

			1. September survey data only				2. Survey effect		3.September & July data where appropriate				
Species	**outlier**	**DF**	β_{length}	**SE**	χ^2	***P***	**Dev-iance**	***P***	**DF**	β_{length}	**SE**	χ^2	***P***
GREENLAND COD	0	58	-0.0219	0.0294	0.55	0.376							
THORNY SKATE	0	156	0.0059	0.0088	0.45	0.557	778.0	0.320	563	0.0065	0.0044	2.16	0.852
SMOOTH SKATE	0	57	0.0292	0.0191	2.33	0.112	242.8	1.000	168	0.0087	0.0108	0.65	0.472
SMOOTH SKATE	1	57					211.1	0.442	149	0.0070	0.0109	0.42	0.444
WINTER SKATE	0	22					53.7	0.950	39	-0.0091	0.0164	0.31	0.905
ATLANTIC HAGFISH	0	38	-0.0450	0.0588	0.58	0.810	186.7	**0.040**					
LONGHORN SCULPIN	0	93	-0.0681	0.0358	3.62	0.064	994.3	**0.010**					
LONGHORN SCULPIN	1	66	-0.0339	0.0420	0.65	0.454	944.8	**0.001**					
SHORTHORN SCULPIN	0	97	0.0162	0.0257	0.40	0.603	156.4	0.890	110	0.0137	0.0244	0.32	0.763
SHORTHORN SCULPIN	1	85	0.0378	0.0290	1.70	0.078	136.0	0.674	98	0.0324	0.0270	1.44	0.156
ARCTIC STAGHORN SCULPIN	0	104	-0.0761	0.0381	4.00	0.537							
ARCTIC STAGHORN SCULPIN	1	93	-0.0757	0.0396	3.65	0.523							
MOUSTACHE SCULPIN	0	237	0.0491	0.0339	2.10	0.122	754.1	0.470	418	0.0807	0.0278	8.40	**0.017**
ARCTIC HOOKEAR SCULPIN	0	36	1.0586	0.5350	3.92	0.611							
SPATULATE SCULPIN	0	128	0.0811	0.0578	1.97	0.051							
SEA RAVEN	0	35	0.0295	0.0418	0.50	0.468	510.0	0.300	334	-0.0334	0.0098	11.7	0.267
SEA RAVEN	1	35					436.2	0.198	300	-0.0051	0.0115	0.20	0.819
ALLIGATORFISH	0	135	0.0525	0.0589	0.79	0.375	393.6	0.410	273	0.1620	0.0402	16.2	**0.002**
ARCTIC ALLIGATORFISH	0	73	-0.2108	0.2334	0.82	0.798							
ATL SEA POACHER	0	143	0.0615	0.0280	4.81	0.190	367.2	**0.010**					
MARLIN-SPIKE GRENADIER	0	60	0.0538	0.0346	2.42	0.128	202.8	0.480	133	0.0303	0.0200	2.28	0.118
ATL SPINY LUMPSUCKER	0	75	-0.0098	0.1091	0.01	0.914	185.8	0.300	124	-0.0334	0.0866	0.15	0.616
DUSKY SEASNAIL	0	148	0.0085	0.0234	0.13	0.725	250.1	0.280	159	0.0183	0.0222	0.68	0.275
NORTHERN SAND LANCE	0	23					2806.8	**0.010**					
FISH DOCTOR	0	40	0.0744	0.1512	0.24	0.702							
LAVAL`S EELPOUT	0	278	0.0007	0.0072	0.01	0.928							
LAVAL`S EELPOUT	1	264	0.0046	0.0072	0.40	0.698							
SNAKEBLENNY	0	96	-0.0057	0.0269	0.04	0.813	350.7	0.290	245	0.0255	0.0154	2.74	0.124
DAUBED SHANNY	0	315	0.1986	0.0318	39.0	**0.001**	1163.5	**0.010**					
4-LINE SNAKE BLENNY	0	180	-0.0767	0.0348	4.85	0.188							

Species	outlier	DF	1. September survey data only				2. Survey effect		3.September & July data where appropriate				
			β_{length}	SE	χ^2	*P*	Dev-iance	*P*	DF	β_{length}	SE	χ^2	*P*
STOUT EELBLENNY	0	141	0.0650	0.0373	3.04	0.192							
VAHL'S EELPOUT	0	137	0.0319	0.0136	5.47	0.287	550.8	0.790	363	0.0069	0.0090	0.58	0.471
VAHL'S EELPOUT	1	94	0.0105	0.0170	0.38	0.577	461.0	0.093	320	-0.0010	0.0094	0.01	0.886
WHITE BARRACUDINA	0	17					242.5	0.910	72	-0.0827	0.0586	1.99	0.525
ATL HOOKEAR SCULPIN	0	85	0.0380	0.1723	0.05	0.825	337.2	0.058	132	-0.0745	0.1256	0.35	0.611
ATL ROCK CRAB	0	145	0.0050	0.0058	0.77	0.499	317.9	**0.010**					
Hyas coarctatus	0	913	0.0033	0.0032	1.08	0.284	2250.9	**0.010**					
Hyas coarctatus	1	846	0.0049	0.0032	2.29	0.176	2097.5	**0.001**					
NORTHERN STONE CRAB	0	37	0.0208	0.0158	1.73	0.368	169.4	0.120	135	0.0120	0.0073	2.73	0.083
SNOW CRAB	0	3451	0.0006	0.0011	0.32	0.852	9754.1	**0.010**					
Hyas araneus	0	173	0.0258	0.0078	10.9	**0.004**	563.0	**0.010**					
Hyas araneus	1	159	0.0309	0.0088	12.3	**0.020**	541.6	**0.001**					
SHORT-FIN SQUID	0	62	0.1695	0.1134	2.23	0.209	1489.9	0.480	466	-0.0613	0.0230	7.11	0.216

Table 8. Results of mixed effects model analyses, with set pairs having ≥20% difference in tow distance removed, testing for (1) a length-dependent difference in catchability between the *CCGS Alfred Needler* and the *CCGS Teleost* based on the September 2004 and 2005 comparative fishing experiments, (2) an interaction between the length and survey effect and (3) a length-dependent difference in catchability based on the combined September and July comparative fishing experiments, where appropriate. The column *outlier* indicates whether outliers were included (value=0) or excluded (=1) from the analysis. *P* is the probability value for the *t*-statistic in (1) and (3) and is the probability value for the *F*-statistic based on Type-III tests of fixed effects in (2).

		1. September survey data only					**2. Survey effect**		**3. September & July data where appropriate**				
species	**outlier**	**DF**	β_{length}	**SE**	***t***	***P***	**F**	***P***	**DF**	β_{length}	**SE**	***t***	***P***
ATL. COD	0	391	0.0035	0.0045	0.775	0.4391	1.208	0.2722	691	0.0002	0.0037	0.047	0.9623
ATL. COD	1	372	0.0015	0.0044	0.340	0.7337	1.259	0.2622	672	-0.0008	0.0037	-0.203	0.8393
WHITE HAKE	0	139	-0.0030	0.0099	-0.306	0.7598	0.021	0.8849	198	-0.0038	0.0082	-0.467	0.6412
REDFISH (SEBASTES SP.)	0	90	0.0078	0.0158	0.491	0.6250	0.130	0.7186	571	0.0185	0.0084	2.207	**0.0277**
REDFISH (SEBASTES SP.)	1	90					0.018	0.8938	554	0.0163	0.0080	2.027	**0.0431**
GREENLAND HALIBUT	0	243	-0.0044	0.0063	-0.707	0.4800	0.114	0.7352	565	-0.0066	0.0063	-1.046	0.2962
GREENLAND HALIBUT	1	243					0.114	0.7352	565	-0.0066	0.0063	-1.046	0.2962
AMERICAN PLAICE	0	463	-0.0062	0.0041	-1.519	0.1295	3.774	0.0524	938	-0.0107	0.0032	-3.355	**0.0008**
AMERICAN PLAICE	1	463					2.150	0.1429	930	-0.0097	0.0031	-3.098	**0.0020**
WITCH FLOUNDER	0	230	-0.0041	0.0163	-0.251	0.8023	2.864	0.0909	860	-0.0068	0.0077	-0.885	0.3763
WITCH FLOUNDER	1	194	-0.0031	0.0164	-0.190	0.8497	2.341	0.1264	824	-0.0078	0.0075	-1.044	0.2970
YELLOWTAIL FLOUNDER	0	311	-0.0124	0.0158	-0.785	0.4331	0.010	0.9219	960	-0.0032	0.0089	-0.362	0.7174
YELLOWTAIL FLOUNDER	1	268	-0.0001	0.0171	-0.007	0.9941	0.055	0.8143	877	0.0004	0.0093	0.042	0.9666
WINTER FLOUNDER	0	236	0.0015	0.0171	0.085	0.9322	0.014	0.9068	439	-0.0032	0.0128	-0.249	0.8034
WINTER FLOUNDER	1	167	0.0177	0.0190	0.931	0.3532	0.065	0.7990	370	0.0066	0.0136	0.484	0.6285
ATL. HERRING	0	537	0.0438	0.0208	2.105	**0.0358**	0.710	0.3998	1066	0.0392	0.0186	2.108	**0.0353**
ATL. HERRING	1	443	0.0356	0.0174	2.045	**0.0415**	0.144	0.7042	972	0.0267	0.0177	1.507	0.1323
GASPEREAU	0	21	0.2558	0.1001			1.077	0.3015	117	0.1206	0.0511	2.359	**0.0200**
CAPELIN	0	253	0.0076	0.0427	0.179	0.8581	0.598	0.4397	343	-0.0124	0.0385	-0.322	0.7476
CAPELIN	1	253					1.215	0.2712	327	-0.0068	0.0384	-0.177	0.8594

species	outlier	1. September survey data only					2. Survey effect		3. September & July data where appropriate				
		DF	β_{length}	SE	t	P	F	P	DF	β_{length}	SE	t	P
THORNY SKATE	0	135	0.0067	0.0102	0.662	0.5092	0.230	0.6321	463	0.0016	0.0057	0.287	0.7740
SMOOTH SKATE	0	47	0.0358	0.0243			0.190	0.6638	118	0.0101	0.0138	0.733	0.4652
SMOOTH SKATE	1	47					0.634	0.4276	101	0.0096	0.0129	0.739	0.4615
ATLANTIC HAGFISH	0	27	-0.0296	0.0625			1.036	0.3120	78	-0.0165	0.0382	-0.431	0.6675
LONGHORN SCULPIN	0	70	-0.0425	0.0393	-1.083	0.2826	9.342	**0.0024**					
LONGHORN SCULPIN	1	45	-0.0324	0.0477	-0.679	0.5006	9.810	**0.0018**					
SHORTHORN SCULPIN	0	65	0.0428	0.0320	1.337	0.1860	0.009	0.9266	71	0.0382	0.0296	1.291	0.2009
SHORTHORN SCULPIN	1	54	0.0393	0.0307	1.281	0.2058	0.191	0.6640	60	0.0336	0.0283	1.186	0.2405
ARCTIC STAGHORN SCULPIN	0	48	0.0208	0.0528	0.393	0.6961							
ARCTIC STAGHORN SCULPIN	1	48											
MOUSTACHE SCULPIN	0	170	0.0405	0.0441	0.918	0.3597	0.455	0.5003	299	0.0918	0.0369	2.488	**0.0134**
SPATULATE SCULPIN	0	82	0.1706	0.0715	2.385	**0.0194**							
SEA RAVEN	0	22	0.0297	0.0426			1.001	0.3179	254	-0.0098	0.0114	-0.862	0.3893
SEA RAVEN	1	22					1.506	0.2210	222	-0.0040	0.0121	-0.330	0.7415
ALLIGATORFISH	0	84	0.0910	0.0671	1.357	0.1784	0.825	0.3651	167	0.1872	0.0472	3.962	**0.0001**
ATL SEA POACHER	0	106	0.0587	0.0301	1.954	0.0534	5.480	**0.0203**					
MARLIN-SPIKE GRENADIER	0	53	0.0310	0.0431	0.720	0.4750	0.216	0.6430	101	0.0135	0.0283	0.478	0.6338
ATL SPINY LUMPSUCKER	0	46	-0.0285	0.1257	-0.227	0.8217	0.851	0.3597	69	-0.0238	0.0930	-0.256	0.7990
DUSKY SEASNAIL	0	97	0.0053	0.0295	0.178	0.8588	1.213	0.2734	99	0.0205	0.0269	0.764	0.4468
NORTHERN SAND LANCE	0	12	0.3891	0.2251			2.203	0.1388	301	0.1084	0.0392	2.767	**0.0060**
LAVAL`S EELPOUT	0	200	-0.0052	0.0097	-0.536	0.5922							
LAVAL`S EELPOUT	1	187	-0.0010	0.0090	-0.108	0.9140							
SNAKEBLENNY	0	76	0.0097	0.0291	0.335	0.7386	0.008	0.9297	198	0.0212	0.0201	1.052	0.2940
DAUBED SHANNY	0	233	0.1167	0.0406	2.877	**0.0044**	4.145	**0.0425**					

		1. September survey data only					2. Survey effect		3. September & July data where appropriate				
species	**outlier**	**DF**	β_{length}	**SE**	t	P	**F**	P	**DF**	β_{length}	**SE**	t	P
4-LINE SNAKE BLENNY	0	127	-0.0733	0.0585	-1.253	0.2126							
STOUT EELBLENNY	0	109	0.0960	0.0538	1.785	0.0770							
OCEAN POUT(COMMON)	0	12	-0.0349	0.0411			3.027	0.0847	108	-0.0170	0.0153	-1.110	0.2695
OCEAN POUT(COMMON)	1	12					3.263	0.0742	92	-0.0241	0.0141	-1.715	0.0896
VAHL'S EELPOUT	0	120	0.0084	0.0238	0.353	0.7247	0.017	0.8974	303	0.0011	0.0138	0.081	0.9358
VAHL'S EELPOUT	1	79	0.0181	0.0193	0.936	0.3523	0.235	0.6283	262	0.0027	0.0136	0.202	0.8405
ATL. HOOKEAR SCULPIN	0	44	-0.1827	0.2034	-0.898	0.3738	0.970	0.3288	67	-0.0996	0.1590	-0.626	0.5332
ATL ROCK CRAB	0	77	0.0052	0.0068	0.772	0.4423	4.537	**0.0352**					
HYAS COARCTATUS	0	340	0.0063	0.0061	1.034	0.3017	1.923	0.1660	576	0.0037	0.0044	0.831	0.4064
Hyas coarctatus	1	329	0.0059	0.0060	0.997	0.3195	2.905	0.0889	565	0.0036	0.0044	0.813	0.4166
NORTHERN STONE CRAB	0	24	0.0161	0.0245	0.657	0.5173	1.512	0.2226	77	0.0113	0.0081	1.392	0.1680
SNOW CRAB	0	640	0.0026	0.0019	1.380	0.1680	24.987	**0.0000**					
Hyas araneus	0	72	0.0332	0.0141	2.362	**0.0209**	2.290	0.1325	138	0.0192	0.0102	1.876	0.0627
Hyas araneus	1	65	0.0314	0.0145	2.170	**0.0337**	2.996	0.0858	131	0.0165	0.0103	1.599	0.1121
SHORT-FIN SQUID	0	38	0.1532	0.1111	1.379	0.1759	0.916	0.3392	329	0.0076	0.0185	0.413	0.6797

Table 9. Results of mixed effects model analyses (all relevant set pairs) testing for (1) a length-dependent difference in catchability between the *CCGS Alfred Needler* and the *CCGS Teleost* based on the September 2004 and 2005 comparative fishing experiments, (2) an interaction between the length and survey effect and (3) a length-dependent difference in catchability based on the combined September and July comparative fishing experiments, where appropriate. The column *outlier* indicates whether outliers were included - 0 or excluded -1 from the analysis. *P* is the probability value for the *t*-statistic in (1) and (3) and is the probability value for the *F*-statistic based on Type-III tests of fixed effects in (2).

		1. September survey data only					**2. Survey effect**		**3. September & July data where appropriate**				
species	**outlier**	**DF**	β_{length}	**SE**	t	P	**F**	P	**DF**	β_{length}	**SE**	t	P
ATL. COD	0	422	0.0018	0.0045	0.40	0.687	0.77	0.381	746	-0.0002	0.0037	-0.07	0.948
ATL. COD	1	403	-0.0001	0.0045	-0.01	0.990	0.79	0.376	727	-0.0011	0.0037	-0.30	0.764
WHITE HAKE	0	139	-0.0030	0.0099	-0.31	0.760	0.05	0.828	210	-0.0075	0.0078	-0.97	0.334
REDFISH (SEBASTES SP.)	0	90	0.0092	0.0158	0.58	0.563	0.07	0.798	597	0.0151	0.0082	1.85	0.065
REDFISH (SEBASTES SP.)	1	90	0.0092	0.0158	0.58	0.563	0.00	0.965	580	0.0131	0.0079	1.66	0.097
GREENLAND HALIBUT	0	243	-0.0047	0.0063	-0.75	0.453	0.97	0.326	597	-0.0106	0.0066	-1.61	0.108
GREENLAND HALIBUT	1	243					0.22	0.643	566	-0.0076	0.0063	-1.21	0.225
AMERICAN PLAICE	0	493	-0.0053	0.0040	-1.33	0.185	4.23	**0.040**					
WITCH FLOUNDER	0	230	-0.0041	0.0163	-0.25	0.802	2.88	0.090	879	-0.0062	0.0076	-0.82	0.414
WITCH FLOUNDER	1	194	-0.0031	0.0164	-0.19	0.850	2.36	0.125	843	-0.0072	0.0074	-0.98	0.328
YELLOWTAIL FLOUNDER	0	337	-0.0119	0.0148	-0.81	0.421	0.00	0.966	990	-0.0023	0.0086	-0.27	0.785
YELLOWTAIL FLOUNDER	1	294	-0.0001	0.0157	-0.01	0.993	0.04	0.845	907	0.0012	0.0090	0.14	0.891
WINTER FLOUNDER	0	243	0.0020	0.0169	0.12	0.908	0.01	0.923	473	0.0011	0.0125	0.09	0.932
WINTER FLOUNDER	1	174	0.0182	0.0187	0.97	0.332	0.05	0.829	404	0.0108	0.0131	0.83	0.410
ATL. HERRING	0	547	0.0440	0.0208	2.12	**0.035**	0.96	0.327	1082	0.0391	0.0185	2.11	**0.035**
ATL. HERRING	1	453	0.0353	0.0174	2.03	**0.043**	0.27	0.607	988	0.0271	0.0177	1.54	0.125
GASPEREAU	0	18					0.97	0.327	117	0.1176	0.0510	2.31	**0.023**
CAPELIN	0	262	0.0289	0.0448	0.65	0.519	0.89	0.345	356	0.0078	0.0391	0.20	0.841
CAPELIN	1	262					1.50	0.221	340	0.0129	0.0392	0.33	0.741
THORNY SKATE	0	135	0.0067	0.0102	0.66	0.509	0.20	0.653	463	0.0019	0.0056	0.33	0.740
SMOOTH SKATE	0	47	0.0358	0.0243	1.47	0.148	0.28	0.600	119	0.0091	0.0138	0.66	0.511
SMOOTH SKATE	1	47					0.77	0.382	102	0.0087	0.0129	0.67	0.502
ATLANTIC HAGFISH	0	27	-0.0296	0.0625	-0.47	0.640	0.85	0.361	78	-0.0156	0.0383	-0.41	0.684
LONGHORN SCULPIN	0	73	-0.0376	0.0387	-0.97	0.334	9.83	**0.002**					
LONGHORN SCULPIN	1	48	-0.0260	0.0460	-0.57	0.574	10.21	**0.001**					
SHORTHORN SCULPIN	0	65	0.0461	0.0320	1.44	0.155	0.01	0.929	71	0.0411	0.0296	1.39	0.169
SHORTHORN SCULPIN	1	54	0.0431	0.0308	1.40	0.168	0.18	0.673	60	0.0369	0.0284	1.30	0.199

species	outlier	1. September survey data only DF	β_{length}	SE	t	P	2. Survey effect F	P	3. September & July data where appropriate DF	β_{length}	SE	t	P
ARCTIC STAGHORN SCULPIN	0	68	-0.0029	0.0524	-0.05	0.957							
ARCTIC STAGHORN SCULPIN	1	58	-0.0108	0.0447	-0.24	0.810							
MOUSTACHE SCULPIN	0	186	0.0410	0.0406	1.01	0.314	0.20	0.652	315	0.0886	0.0353	2.51	**0.013**
SPATULATE SCULPIN	0	87	0.1795	0.0702	2.56	**0.012**							
SEA RAVEN	0	22	0.0296	0.0424	0.70	0.493	1.28	0.260	260	-0.0113	0.0112	-1.01	0.314
SEA RAVEN	1	22	0.0296	0.0424	0.70	0.493	1.78	0.184	228	-0.0050	0.0119	-0.42	0.673
ALLIGATORFISH	0	95	0.0898	0.0646	1.39	0.168	1.74	0.189	179	0.1815	0.0464	3.91	**<0.001**
ATL SEA POACHER	0	106	0.0595	0.0300	1.98	**0.050**	5.58	**0.019**					
MARLIN-SPIKE GRENADIER	0	53	0.0310	0.0431	0.72	0.475	0.53	0.469	110	0.0228	0.0257	0.89	0.377
ATL SPINY LUMPSUCKER	0	50	-0.0202	0.1204	-0.17	0.867	0.49	0.484	73	-0.0257	0.0908	-0.28	0.778
DUSKY SEASNAIL	0	107	0.0061	0.0277	0.22	0.826	1.37	0.245	109	0.0201	0.0255	0.79	0.432
NORTHERN SAND LANCE	0	12					2.82	0.094	301	0.1075	0.0391	2.75	**0.006**
LAVAL`S EELPOUT	0	230	-0.0038	0.0089	-0.42	0.674							
LAVAL`S EELPOUT	1	217	0.0003	0.0084	0.03	0.975							
SNAKEBLENNY	0	76	0.0097	0.0291	0.33	0.739	0.01	0.933	201	0.0188	0.0199	0.94	0.347
DAUBED SHANNY	0	246	0.1315	0.0406	3.24	**0.001**	4.65	**0.032**					
4-LINE SNAKE BLENNY	0	153	-0.0463	0.0489	-0.95	0.345							
STOUT EELBLENNY	0	111	0.0969	0.0535	1.81	0.073							
OCEAN POUT(COMMON)	0	12					2.88	0.092	115	-0.0114	0.0151	-0.75	0.452
OCEAN POUT(COMMON)	1	12					3.08	0.082	99	-0.0175	0.0136	-1.29	0.201
VAHL'S EELPOUT	0	120	0.0084	0.0238	0.35	0.725	0.05	0.831	316	0.0023	0.0134	0.17	0.863
VAHL'S EELPOUT	1	79	0.0181	0.0193	0.94	0.352	0.34	0.563	275	0.0039	0.0132	0.30	0.768
ATL HOOKEAR SCULPIN	0	49	-0.1170	0.1951	-0.60	0.551	0.86	0.357	72	-0.0587	0.1542	-0.38	0.705
ATL ROCK CRAB	0	77	0.0055	0.0068	0.82	0.417	3.87	0.052	122	0.0017	0.0066	0.26	0.793
Hyas coarctatus	0	386	0.0063	0.0058	1.08	0.282	2.78	0.096	622	0.0040	0.0043	0.93	0.353
Hyas coarctatus	1	365	0.0072	0.0058	1.26	0.209	3.92	**0.048**					
NORTHERN STONE CRAB	0	24					1.65	0.203	80	0.0120	0.0079	1.51	0.135
SNOW CRAB	0	688	0.0037	0.0019	1.98	**0.049**	22.38	**<0.001**					
Hyas araneus	0	83	0.0333	0.0123	2.71	**0.008**	1.55	0.215	151	0.0198	0.0095	2.08	**0.039**
Hyas araneus	1	76	0.0312	0.0124	2.51	**0.014**	2.08	0.152	144	0.0174	0.0096	1.82	0.071
SHORT-FIN SQUID	0	38	0.1561	0.1092	1.43	0.161	0.75	0.388	335	0.0071	0.0183	0.39	0.699

Table 10. Results of fixed effects model analyses, with set pairs having ≥20% difference in tow distance removed, testing for (1) a depth-dependent difference in catchability between the *CCGS Alfred Needler* and the *CCGS Teleost* based on the September 2004 and 2005 comparative fishing experiments, (2) an interaction between the length and survey effect and (3) a depth-dependent difference in catchability based on the combined September and July comparative fishing experiments, where appropriate. The column *outlier* indicates whether outliers were included (value=0) or excluded (=1) from the analysis. Probability values are based on 999 permutations under the null hypothesis.

		1. September survey data only					2.Survey effect		3.September & July data where appropriate				
Species	**outlier**	**DF**	β_{depth}	**SE**	χ^2	***P***	**Deviance**	***P***	**DF**	β_{depth}	**SE**	χ^2	***P***
ATL. COD	0	80	0.0076	0.0022	11.86	0.1760	2092.5	0.2910	258	0.0065	0.0022	9.00	0.2670
ATL. COD	1	80					1559.8	0.1070	255	0.0079	0.0017	20.81	0.0850
WHITE HAKE	0	19	-0.0008	0.0009	0.91	0.4710	141.4	0.5530	49	-0.0002	0.0009	0.08	0.7760
REDFISH (SEBASTES SP.)	0	22	-0.0010	0.0018	0.29	0.8410	5215.1	0.8430	254	-0.0006	0.0011	0.32	0.7090
REDFISH (SEBASTES SP.)	1	22					4055.1	0.3640	251	0.0007	0.0010	0.59	0.5940
HALIBUT(ATLANTIC)	0	9							63	0.0014	0.0037	0.15	0.7730
GREENLAND HALIBUT	0	36	-0.0014	0.0016	0.79	0.7040	695.9	0.6810	103	-0.0013	0.0011	1.42	0.5740
AMERICAN PLAICE	0	88	0.0009	0.0012	0.60	0.5230	3022.0	0.9900	366	-0.0001	0.0010	0.02	0.9250
WITCH FLOUNDER	0	22	-0.0005	0.0027	0.04	0.9060	1070.9	0.7950	205	0.0006	0.0012	0.26	0.7750
WITCH FLOUNDER	1	21	0.0025	0.0022	1.22	0.6440	993.0	0.9370	204	0.0005	0.0011	0.20	0.8020
YELLOWTAIL FLOUNDER	0	35	-0.0201	0.0078	6.56	0.1740	954.6	0.1100	171	-0.0101	0.0038	7.06	0.0860
WINTER FLOUNDER	0	17	-0.0425	0.0296	2.06	0.4030	543.2	0.3310	68	-0.0221	0.0091	5.95	0.2780
WINTER FLOUNDER	1	15	-0.0030	0.0216	0.02	0.9230	371.9	0.6550	66	-0.0104	0.0076	1.91	0.4290
STRIPED ATL WOLFFISH	0	4							60	-0.0022	0.0104	0.04	0.8750
ATL. HERRING	0	55	-0.0014	0.0116	0.01	0.9180	5445.8	0.4230	235	-0.0093	0.0029	10.19	0.1120
ATL. HERRING	1	51	-0.0069	0.0059	1.38	0.3530	3275.8	0.2730	231	-0.0087	0.0020	18.70	**0.0330**
GASPEREAU	0	5							49	0.0084	0.0074	1.31	0.9690
GASPEREAU	1	4							48	-0.0128	0.0060	4.59	0.1280
CAPELIN	0	58	0.0000	0.0019	0.00	0.9930	2177.6	0.1280	102	0.0010	0.0031	0.10	0.7810
CAPELIN	1	58					782.8	0.6300	94	-0.0029	0.0018	2.47	0.2980
ATL. MACKEREL	0	16	0.0427	0.0291	2.15	0.2240	119.8	0.4520	24	0.0420	0.0223	3.54	0.1390
LONGFIN HAKE	0	3							48	-0.0025	0.0033	0.55	0.5570
FOURBEARD ROCKLING	0	16	0.0034	0.0024	2.05	0.3320	121.6	0.5810	48	0.0023	0.0023	0.96	0.5270
GREENLAND COD	0	24	-0.0008	0.0109	0.01	0.9450							

		1. September survey data only					2.Survey effect		3.September & July data where appropriate				
Species	**outlier**	**DF**	β_{depth}	**SE**	χ^2	***P***	**Deviance**	***P***	**DF**	β_{depth}	**SE**	χ^2	***P***
THORNY SKATE	0	20	-0.0009	0.0022	0.15	0.7430	491.1	0.8690	142	0.0009	0.0017	0.31	0.5650
SMOOTH SKATE	0	9	-0.0012	0.0033	0.14	0.6900	124.5	0.7310	57	-0.0019	0.0026	0.52	0.4920
WINTER SKATE	0	4							17	-0.0038	0.0045	0.70	0.6530
ATLANTIC HAGFISH	0	10	0.0078	0.0077	1.04	0.4100	138.3	0.8560	51	-0.0048	0.0027	3.07	0.4350
LONGHORN SCULPIN	0	17	-0.0402	0.0275	2.13	0.2730	623.2	0.2460	161	-0.0157	0.0046	11.47	**0.0300**
SHORTHORN SCULPIN	0	29	-0.0073	0.0137	0.29	0.7090	73.1	0.7940	37	-0.0053	0.0127	0.17	0.7710
ARCTIC STAGHORN SCULPIN	0	30	-0.0334	0.0075	20.11	**0.0390**							
MOUSTACHE SCULPIN	0	48	-0.0010	0.0048	0.05	0.8820	435.9	0.7970	122	0.0038	0.0038	1.02	0.4440
ARCTIC HOOKEAR SCULPIN	0	19	-0.0542	0.0534	1.03	0.4050	89.5	0.3350	20	-0.0497	0.0500	0.99	0.4200
SPATULATE SCULPIN	0	37	-0.0131	0.0170	0.60	0.5240	98.9	0.5490	40	-0.0133	0.0166	0.64	0.5380
SEA RAVEN	0	11	0.0325	0.0333	0.96	0.4230	363.7	0.2810	99	0.0170	0.0111	2.34	0.3330
ALLIGATORFISH	0	37	0.0008	0.0048	0.03	0.8880	247.5	0.6680	107	0.0005	0.0039	0.02	0.9200
ARCTIC ALLIGATORFISH	0	25	-0.0613	0.0520	1.39	0.2910							
ATL SEA POACHER	0	35	0.0088	0.0069	1.61	0.1920	194.9	0.4060	77	0.0025	0.0064	0.16	0.7020
THREESPINE STICKLEBACK	0	12	0.0013	0.0042	0.10	0.8480							
MARLIN-SPIKE GRENADIER	0	6							30	0.0009	0.0032	0.09	0.7900
ATL SPINY LUMPSUCKER	0	22	0.0194	0.0183	1.12	0.3350	90.0	0.2290	50	0.0100	0.0115	0.75	0.4130
DUSKY SEASNAIL	0	37	0.0036	0.0131	0.08	0.8690	109.6	0.9350	48	0.0037	0.0118	0.10	0.8730
NORTHERN SAND LANCE	0	9					2787.9	0.8420	86	0.0116	0.0169	0.47	0.6910
FISH DOCTOR	0	11	0.0425	0.0706	0.36	0.6790							
LAVAL'S EELPOUT	0	42	0.0155	0.0083	3.52	0.1250							
SNAKEBLENNY	0	19	0.0045	0.0068	0.44	0.5930	214.3	0.1350	58	0.0086	0.0079	1.18	0.2920
DAUBED SHANNY	0	64	0.0005	0.0028	0.03	0.8700	526.6	0.2880	17	-0.0018	0.0029	0.39	0.6530
4-LINE SNAKE BLENNY	0	23	-0.0145	0.0087	2.82	0.1720			23	-0.0145	0.0087	2.82	0.1940
STOUT EELBLENNY	0	27	0.0038	0.0050	0.56	0.5490			27	0.0038	0.0050	0.56	0.5040
OCEAN POUT(COMMON)	0	7							48	0.0113	0.0123	0.84	0.4720
VAHL'S EELPOUT	0	16	-0.0004	0.0054	0.01	0.9630	335.2	0.9220	66	-0.0015	0.0045	0.11	0.8350
WHITE BARRACUDINA	0	5							24	0.0118	0.0063	3.51	0.4950

Species	outlier	1. September survey data only DF	β_{depth}	SE	χ^2	*P*	2.Survey effect Deviance	*P*	3.September & July data where appropriate DF	β_{depth}	SE	χ^2	*P*
ATL. HOOKEAR SCULPIN	0	31	-0.0008	0.0059	0.02	0.9270	251.1	0.6660	57	-0.0001	0.0053	0.00	0.9840
ATL ROCK CRAB	0	14	-0.0059	0.0146	0.16	0.6440	121.0	0.7220	40	-0.0166	0.0122	1.84	0.3720
Hyas coarctatus	0	66	-0.0049	0.0060	0.66	0.5070	1122.8	0.5530	154	-0.0105	0.0058	3.33	0.1930
Hyas coarctatus	1	65	-0.0045	0.0054	0.68	0.5290	810.9	0.4250	151	-0.0145	0.0055	6.99	0.1270
NORTHERN STONE CRAB	0	9					142.7	0.5020	54	0.0009	0.0032	0.08	0.8000
SNOW CRAB	0	83	-0.0011	0.0034	0.10	0.8360	4002.1	0.4500	272	-0.0032	0.0025	1.67	0.4360
SNOW CRAB	1	83					3472.4	0.3500	269	-0.0045	0.0024	3.47	0.3060
Hyas araneus	0	42	-0.0094	0.0110	0.73	0.5600	395.8	0.1870	90	-0.0061	0.0098	0.39	0.8050
Hyas araneus	1	42					350.6	0.3450	89	-0.0066	0.0092	0.52	0.7370
SHORT-FIN SQUID	0	22	-0.0083	0.0035	5.64	**0.0320**	1248.6	0.8130	187	-0.0008	0.0022	0.14	0.8630

Table 11. Results of fixed effects model analyses (all relevant set pairs) testing for (1) a depth-dependent difference in catchability between the *CCGS Alfred Needler* and the *CCGS Teleost* based on the September 2004 and 2005 comparative fishing experiments, (2) an interaction between the length and survey effect and (3) a depth-dependent difference in catchability based on the combined September and July comparative fishing experiments, where appropriate. The column *outlier* indicates whether outliers were included (value=0) or excluded (=1) from the analysis. Probability values are based on 999 permutations under the null hypothesis.

		1. September survey data only					2.Survey effect		3.September & July data where appropriate				
Species	**outlier**	**DF**	β_{depth}	**SE**	χ^2	*P*	**Deviance**	*P*	**DF**	β_{depth}	**SE**	χ^2	*P*
ATL. COD	0	86	0.0067	0.0023	8.23	0.212	2415.67	0.307	275	0.0070	0.0022	10.40	0.195
ATL. COD	1	86					1797.4	0.079	272	0.0084	0.0018	22.62	0.070
WHITE HAKE	0	19	-0.0008	0.0009	0.91	0.473	168.4	0.480	52	-0.0006	0.0009	0.49	0.528
REDFISH (SEBASTES SP.)	0	23	-0.0008	0.0017	0.24	0.865	5342.2	0.799	265	-0.0007	0.0011	0.44	0.665
REDFISH (SEBASTES SP.)	1	23					4192.6	0.432	262	0.0006	0.0010	0.41	0.686
HALIBUT(ATLANTIC)	0	9					153.1	0.890	63	0.0014	0.0037	0.15	0.767
GREENLAND HALIBUT	0	37	-0.0014	0.0015	0.86	0.652	862.6	0.792	108	-0.0002	0.0011	0.05	0.912
AMERICAN PLAICE	0	94	0.0008	0.0012	0.43	0.592	3129.6	0.964	382	-0.0003	0.0010	0.08	0.838
WITCH FLOUNDER	0	22	-0.0005	0.0027	0.04	0.917	1100.4	0.777	213	0.0006	0.0012	0.27	0.773
WITCH FLOUNDER	1	21	0.0025	0.0022	1.22	0.636	1022.5	0.937	212	0.0005	0.0011	0.20	0.794
YELLOWTAIL FLOUNDER	0	39	-0.0197	0.0072	7.49	0.149	964.2	0.082	177	-0.0101	0.0037	7.39	0.069
WINTER FLOUNDER	0	18	-0.0429	0.0288	2.21	0.384	559.3	0.278	73	-0.0236	0.0080	8.77	0.234
WINTER FLOUNDER	1	16	-0.0035	0.0210	0.03	0.918	390.6	0.517	71	-0.0138	0.0068	4.14	0.253
STRIPED ATL WOLFFISH	0	4					168.3	0.981	61	-0.0021	0.0105	0.04	0.878
ATL. HERRING	0	39	-0.0015	0.0112	0.02	0.930	5486.0	0.441	244	-0.0092	0.0029	10.44	0.114
ATL. HERRING	1	35	-0.0070	0.0057	1.51	0.334	3314.1	0.299	240	-0.0087	0.0020	19.05	**0.027**
GASPEREAU	0	5							50	0.0085	0.0073	1.34	0.965
GASPEREAU	1	4							49	-0.0127	0.0059	4.57	0.124
CAPELIN	0	40	0.0007	0.0020	0.11	0.799	2294.7	0.126	107	0.0014	0.0030	0.20	0.683
CAPELIN	1	40					928.8	0.717	99	-0.0024	0.0019	1.62	0.376
ATL. MACKEREL	0	9	0.0537	0.0267	4.05	0.101	136.7	0.279	28	0.0477	0.0219	4.74	0.081
LONGFIN HAKE	0	3							50	-0.0025	0.0033	0.56	0.539
FOURBEARD ROCKLING	0	7	0.0035	0.0023	2.26	0.309	128.6	0.593	52	0.0022	0.0023	0.95	0.559
GREENLAND COD	0	7	0.0013	0.0100	0.02	0.898							
THORNY SKATE	0	0	-0.0009	0.0022	0.15	0.723	492.0	0.853	144	0.0009	0.0017	0.31	0.580

		1. September survey data only					2.Survey effect		3.September & July data where appropriate				
Species	outlier	DF	β_{depth}	SE	χ^2	P	Deviance	P	DF	β_{depth}	SE	χ^2	P
SMOOTH SKATE	0	9					129.8	0.749	59	-0.0018	0.0026	0.50	0.475
WINTER SKATE	0	4					40.1	0.756	17	-0.0038	0.0045	0.70	0.638
ATLANTIC HAGFISH	0	10	0.0078	0.0077	1.04	0.414	141.2	0.868	52	-0.0047	0.0027	2.99	0.399
LONGHORN SCULPIN	0	19	-0.0458	0.0270	2.88	0.210	648.3	0.208	169	-0.0162	0.0046	12.42	**0.023**
SHORTHORN SCULPIN	0	31	-0.0093	0.0134	0.47	0.628	75.6	0.699	39	-0.0070	0.0126	0.31	0.693
ARCTIC STAGHORN SCULPIN	0	35	-0.0353	0.0083	18.18	**0.048**							
MOUSTACHE SCULPIN	0	50	-0.0004	0.0048	0.01	0.951	439.9	0.746	125	0.0037	0.0038	0.97	0.450
ARCTIC HOOKEAR SCULPIN	0	21	-0.0361	0.0408	0.78	0.485	96.7	0.428	22	-0.0332	0.0380	0.76	0.503
SPATULATE SCULPIN	0	40	-0.0053	0.0163	0.11	0.793	113.6	0.779	43	-0.0056	0.0159	0.12	0.775
SEA RAVEN	0	12	0.0332	0.0333	0.99	0.409	375.3	0.223	105	0.0174	0.0109	2.55	0.343
ALLIGATORFISH	0	39	0.0019	0.0049	0.14	0.739	258.2	0.797	110	0.0011	0.0039	0.07	0.808
ARCTIC ALLIGATORFISH	0	27	-0.0673	0.0515	1.71	0.246							
ATL SEA POACHER	0	36	0.0084	0.0068	1.50	0.208	201.5	0.419	80	0.0022	0.0064	0.12	0.754
THREESPINE STICKLEBACK	0	12	0.0013	0.0042	0.10	0.850							
MARLIN-SPIKE GRENADIER	0	6							33	0.0003	0.0028	0.01	0.927
ATL SPINY LUMPSUCKER	0	24	0.0193	0.0177	1.19	0.337	96.0	0.527	53	0.0064	0.0110	0.34	0.625
DUSKY SEASNAIL	0	40	0.0049	0.0125	0.15	0.826	110.5	0.900	51	0.0049	0.0113	0.19	0.823
NORTHERN SAND LANCE	0	10	0.0408	0.0351	1.35	0.414	2788.3	0.814	87	0.0116	0.0169	0.47	0.701
FISH DOCTOR	0	14	0.0477	0.0633	0.57	0.604	55.5	0.605	15	0.0366	0.0585	0.39	0.695
LAVAL`S EELPOUT	0	47	0.0139	0.0080	3.06	0.127	94.8	0.131	48	0.0159	0.0078	4.15	0.077
SNAKEBLENNY	0	19	0.0045	0.0068	0.44	0.606	219.6	0.164	60	0.0082	0.0078	1.10	0.342
DAUBED SHANNY	0	68	0.0020	0.0029	0.47	0.514	597.5	0.267	123	0.0000	0.0029	0.00	0.999
4-LINE SNAKE BLENNY	0	26	-0.0145	0.0073	3.95	0.102							
STOUT EELBLENNY	0	29	0.0037	0.0049	0.56	0.528							
OCEAN POUT(COMMON)	0	7							50	0.0123	0.0124	0.98	0.449
VAHL'S EELPOUT	0	16	-0.0004	0.0054	0.01	0.975	351.6	0.885	71	-0.0016	0.0045	0.12	0.851
WHITE BARRACUDINA	0	5							24	0.0118	0.0063	3.51	0.501
ATL. HOOKEAR	0	35	0.0000	0.0059	0.00	0.995	267.3	0.654	62	0.0003	0.0052	0.00	0.975

Species	outlier	1. September survey data only DF	β_{depth}	SE	χ^2	*P*	2.Survey effect Deviance	*P*	3.September & July data where appropriate DF	β_{depth}	SE	χ^2	*P*
SCULPIN													
ATL ROCK CRAB	0	15	-0.0072	0.0142	0.25	0.590	127.1	0.731	43	-0.0159	0.0118	1.81	0.358
Hyas coarctatus	0	72	-0.0039	0.0060	0.42	0.623	1205.1	0.643	162	-0.0094	0.0056	2.80	0.234
Hyas coarctatus	1	71	-0.0037	0.0056	0.44	0.599	894.2	0.474	159	-0.0134	0.0054	6.06	0.146
NORTHERN STONE CRAB	0	9	0.0019	0.0078	0.06	0.852	146.9	0.499	57	0.0010	0.0031	0.11	0.797
SNOW CRAB	0	90	0.0003	0.0035	0.01	0.950	4283.1	0.573	284	-0.0033	0.0025	1.74	0.471
SNOW CRAB	1	90					3777.0	0.486	281	-0.0045	0.0024	3.45	0.288
Hyas araneus	0	47	-0.0111	0.0104	1.12	0.467	424.9	0.299	98	-0.0080	0.0095	0.71	0.731
Hyas araneus	1	47					375.3	0.374	97	-0.0081	0.0089	0.82	0.627
SHORT-FIN SQUID	0	23	-0.0080	0.0034	5.52	**0.030**	1260.5	0.818	192	-0.0008	0.0022	0.13	0.870

Table 12. Results of mixed effects model analyses, with set pairs having ≥20% difference in tow distance removed, testing for (1) a depth-dependent difference in catchability between the *CCGS Alfred Needler* and the *CCGS Teleost* based on the September 2004 and 2005 comparative fishing experiments, (2) an interaction between the length and survey effect and (3) a depth-dependent difference in catchability based on the combined September and July comparative fishing experiments, where appropriate. The column *outlier* indicates whether outliers were included (value=0) or excluded (=1) from the analysis. *P* is the probability value for the *t*-statistic in (1) and (3) and is the probability value for the *F*-statistic based on Type-III tests of fixed effects in (2).

		1. September survey data only					2. Survey effect		3. September & July data where appropriate				
Species	**outlier**	**DF**	β_{depth}	**SE**	t	P	**F**	P	**DF**	β_{depth}	**SE**	t	P
ATL. COD	0	79	0.0006	0.0023	0.256	0.7984	0.396	0.6742	73	0.0020	0.0023	0.886	0.3784
ATL. COD	1	79					0.734	0.4837	71	0.0025	0.0022	1.173	0.2645
WHITE HAKE	0	19	-0.0006	0.0010	-0.592	0.5611	0.089	0.9149	15	-0.0004	0.0010	-0.425	0.6767
REDFISH (SEBASTES SP.)	0	22	-0.0019	0.0019	-0.995	0.3307	4.090	**0.0193**					
REDFISH (SEBASTES SP.)	1	22					4.493	**0.0133**					
GREENLAND HALIBUT	0	36	-0.0029	0.0018	-1.569	0.1253	0.065	0.9372	34	-0.0006	0.0015	-0.385	0.7024
AMERICAN PLAICE	0	88	0.0002	0.0009	0.210	0.8338	1.497	0.2275	138	-0.0001	0.0009	-0.097	0.9233
WITCH FLOUNDER	0	22	-0.0008	0.0026	-0.317	0.7542	0.875	0.4208	85	0.0010	0.0013	0.737	0.4630
WITCH FLOUNDER	1	21	0.0005	0.0021	0.243	0.8103	0.462	0.6314	85	0.0009	0.0012	0.772	0.4423
YELLOWTAIL FLOUNDER	0	35	-0.0008	0.0103	-0.080	0.9365	4.059	**0.0220**					
WINTER FLOUNDER	0	17	-0.0348	0.0176	-1.970	0.0654	2.896	0.0798	20	-0.0193	0.0092	-2.093	**0.0493**
WINTER FLOUNDER	1	15	-0.0308	0.0172	-1.793	0.0932	2.481	0.1103	20	-0.0180	0.0091	-1.973	0.0624
ATL. HERRING	0	54	-0.0086	0.0056	-1.521	0.1340	1.878	0.1596	80	-0.0064	0.0037	-1.749	0.0842
ATL. HERRING	1	49	-0.0081	0.0033	-2.488	**0.0163**	1.695	0.1901	80	-0.0055	0.0031	-1.801	0.0755
CAPELIN	0	57	0.0002	0.0025	0.081	0.9360	1.974	0.1734	16	0.0005	0.0027	0.194	0.8488
CAPELIN	1	57					2.353	0.1454	11	-0.0012	0.0023	-0.498	0.6281
LONGFIN HAKE	0	3					0.892	0.4263	20	0.0030	0.0050	0.587	0.5635
GREENLAND COD	0	24	-0.0015	0.0111	-0.132	0.8964							
THORNY SKATE	0	20	-0.0006	0.0023	-0.256	0.8002	0.109	0.8972	44	-0.0003	0.0013	-0.197	0.8448
SMOOTH SKATE	0	9					0.268	0.7710	10	-0.0015	0.0025	-0.590	0.5683
ATLANTIC HAGFISH	0	10	0.0060	0.0072	0.827	0.4278	0.334	0.7245	10	-0.0019	0.0031	-0.605	0.5588
LONGHORN SCULPIN	0	17	-0.0183	0.0239	-0.768	0.4531	6.002	**0.0041**					
SHORTHORN SCULPIN	0	29	-0.0001	0.0151	-0.005	0.9960	0.063	0.9390	36	0.0012	0.0142	0.083	0.9347
ARCTIC STAGHORN SCULPIN	0	30	-0.0224	0.0132	-1.694	0.1006	2.870	0.1006	30	-0.0224	0.0132	-1.694	0.1006

MOUSTACHE SCULPIN	0	48	0.0004	0.0058	0.069	0.9456	0.477	0.6272	22	0.0021	0.0040	0.521	0.6075
ARCTIC HOOKEAR SCULPIN	0	19	-0.0319	0.0382	-0.835	0.4141							
SPATULATE SCULPIN	0	37	0.0036	0.0161	0.224	0.8241							
SEA RAVEN	0	11	0.0308	0.0321	0.961	0.3571	1.865	0.1743	28	0.0160	0.0102	1.573	0.1269
ALLIGATORFISH	0	37	0.0028	0.0057	0.499	0.6206	0.219	0.8062	16	0.0004	0.0040	0.089	0.9299
ARCTIC ALLIGATORFISH	0	25	-0.0939	0.0669	-1.405	0.1724	1.974	0.1724	25	-0.0939	0.0669	-1.405	0.1724
ATL SEA POACHER	0	35	0.0072	0.0072	1.000	0.3243	3.482	0.0527	19	0.0037	0.0057	0.639	0.5303
THREESPINE STICKLEBACK	0	12	0.0060	0.0073	0.822	0.4269	0.676	0.4269	12	0.0060	0.0073	0.822	0.4269
ATL SPINY LUMPSUCKER	0	22	0.0239	0.0205	1.168	0.2551	1.038	0.5702	2	0.0091	0.0125	0.729	0.5417
DUSKY SEASNAIL	0	37	-0.0010	0.0137	-0.075	0.9405	0.165		1	-0.0015	0.0125	-0.124	0.9215
FISH DOCTOR	0	11	0.0937	0.0818	1.145	0.2764							
LAVAL`S EELPOUT	0	42	0.0134	0.0093	1.445	0.1557							
SNAKEBLENNY	0	19	0.0048	0.0099	0.488	0.6312	1.473	0.2627	15	0.0106	0.0074	1.444	0.1694
DAUBED SHANNY	0	64	-0.0014	0.0045	-0.323	0.7477	6.003	**0.0083**					
4-LINE SNAKE BLENNY	0	23	-0.0143	0.0138	-1.031	0.3134	1.062	0.3134	23	-0.0143	0.0138	-1.031	0.3134
STOUT EELBLENNY	0	27	0.0097	0.0132	0.738	0.4666	0.545	0.4666	27	0.0097	0.0132	0.738	0.4666
OCEAN POUT(COMMON)	0	7					4.096	**0.0468**					
VAHL'S EELPOUT	0	16	0.0004	0.0080	0.055	0.9570	0.139	0.8709	21	-0.0007	0.0050	-0.130	0.8977
WHITE BARRACUDINA	0	5					0.063	0.9401	6	0.0019	0.0068	0.286	0.7848
ATL. HOOKEAR SCULPIN	0	31	0.0009	0.0081	0.109	0.9142	0.714	0.6419	2	0.0008	0.0069	0.111	0.9217
Hyas coarctatus	0	66	-0.0047	0.0050	-0.943	0.3491	2.612	0.0906	30	-0.0080	0.0048	-1.669	0.1055
Hyas coarctatus	1	65	-0.0042	0.0046	-0.900	0.3715	5.914	**0.0070**					
NORTHERN STONE CRAB	0	9	0.0031	0.0115	0.273	0.7912	1.753	0.2119	14	0.0001	0.0029	0.031	0.9756
SNOW CRAB	0	83	0.0023	0.0020	1.193	0.2361	4.991	**0.0086**					
SNOW CRAB	1	83					7.808	**0.0007**					
Hyas araneus	0	42	-0.0218	0.0174	-1.256	0.2161	4.045	0.1095	5	0.0036	0.0100	0.362	0.7319
SHORT-FIN SQUID	0	22	-0.0081	0.0034	-2.402	**0.0252**	0.003	0.9974	59	-0.0001	0.0027	-0.033	0.9736
SHORT-FIN SQUID	1	22					0.001	0.9995	58	-0.0001	0.0026	-0.032	0.9745

Table 13. Results of mixed effects model analyses (all relevant set pairs) testing for (1) a depth-dependent difference in catchability between the *CCGS Alfred Needler* and the *CCGS Teleost* based on the September 2004 and 2005 comparative fishing experiments, (2) an interaction between the length and survey effect and (3) a depth-dependent difference in catchability based on the combined September and July comparative fishing experiments, where appropriate. The column *outlier* indicates whether outliers were included (value=0) or excluded (=1) from the analysis. *P* is the probability value for the *t*-statistic in (1) and (3) and is the probability value for the *F*-statistic based on Type-III tests of fixed effects in (2).

		1. September survey data only					**2. Survey effect**		**3. September & July data where appropriate**				
Species	**outlier**	**DF**	β_{depth}	**SE**	t	P	**F**	P	**DF**	β_{depth}	**SE**	t	P
ATL. COD	0	85	-0.0008	0.0025	-0.31	0.756	1.08	0.346	80	0.0024	0.0024	1.02	0.312
ATL. COD	1	85					0.55	0.578	78	0.0029	0.0023	1.29	0.202
WHITE HAKE	0	19	-0.0006	0.0010	-0.59	0.561	0.17	0.846	17	-0.0005	0.0009	-0.59	0.561
REDFISH (SEBASTES SP.)	1	23	-0.0015	0.0019	-0.77	0.448	3.84	**0.024**					
ATLANTIC HALIBUT	0	9					0.31	0.737	14	0.0028	0.0037	0.76	0.458
GREENLAND HALIBUT	0	37	-0.0030	0.0018	-1.63	0.111	0.08	0.927	36	-0.0002	0.0016	-0.09	0.926
AMERICAN PLAICE	0	94	0.0002	0.0009	0.20	0.841	1.85	0.161	144	-0.0003	0.0009	-0.33	0.744
WITCH FLOUNDER	0	22	-0.0008	0.0026	-0.32	0.754	0.49	0.612	90	0.0009	0.0013	0.71	0.480
WITCH FLOUNDER	1	21	0.0005	0.0021	0.24	0.810	0.95	0.389	90	0.0009	0.0012	0.75	0.457
YELLOWTAIL FLOUNDER	0	39	-0.0025	0.0093	-0.27	0.791	4.17	**0.020**					
WINTER FLOUNDER	0	18	-0.0350	0.0175	-2.00	0.061	3.29	0.057	22	-0.0198	0.0088	-2.26	**0.034**
WINTER FLOUNDER	1	16	-0.0308	0.0170	-1.81	0.089	2.83	0.081	22	-0.0185	0.0087	-2.13	**0.044**
STRIPED ATL WOLFFISH	0	4					0.12	0.891	11	-0.0037	0.0094	-0.39	0.705
ATL. HERRING	0	58	-0.0088	0.0056	-1.57	0.122	1.56	0.217	82	-0.0062	0.0036	-1.70	0.094
ATL. HERRING	1	53	-0.0082	0.0033	-2.46	**0.017**	1.83	0.167	82	-0.0053	0.0031	-1.71	0.091
CAPELIN	0	59	0.0010	0.0029	0.36	0.717	2.26	0.135	18	0.0010	0.0029	0.36	0.725
CAPELIN	1	59					2.38	0.134	13	-0.0006	0.0026	-0.22	0.833
ATL. MACKEREL	0	19	0.0120	0.0436	0.28	0.785							
LONGFIN HAKE	0	3	0.0151	0.0140	1.08	0.360	0.86	0.437	21	0.0028	0.0049	0.58	0.569
FOURBEARD ROCKLING	0	17	0.0019	0.0033	0.57	0.578	0.12	0.886	8	0.0002	0.0027	0.09	0.929

Species	outlier	1. September survey data only DF	β_{depth}	SE	t	P	2. Survey effect F	P	3. September & July data where appropriate DF	β_{depth}	SE	t	P
GREENLAND COD	0	27	0.0012	0.0101	0.12	0.908							
THORNY SKATE	0	20	-0.0006	0.0023	-0.26	0.800	0.09	0.911	44	-0.0003	0.0013	-0.20	0.844
SMOOTH SKATE	0	9					0.19	0.834	10	-0.0014	0.0025	-0.54	0.601
ATLANTIC HAGFISH	0	10	0.0060	0.0072	0.83	0.428	0.25	0.784	10	-0.0017	0.0031	-0.55	0.596
LONGHORN SCULPIN	0	19	-0.0269	0.0230	-1.17	0.257	6.15	**0.004**					
SHORTHORN SCULPIN	0	31	-0.0029	0.0149	-0.20	0.845	0.08	0.922	38	-0.0014	0.0140	-0.10	0.920
ARCTIC STAGHORN SCULPIN	0	35	-0.0193	0.0142	-1.36	0.182							
MOUSTACHE SCULPIN	0	50	0.0012	0.0057	0.22	0.830	0.39	0.680	22	0.0022	0.0040	0.56	0.581
ARCTIC HOOKEAR SCULPIN	0	21	-0.0284	0.0341	-0.83	0.415							
SPATULATE SCULPIN	0	40	0.0134	0.0170	0.79	0.436							
SEA RAVEN	0	12	0.0316	0.0324	0.98	0.349	2.26	0.122	31	0.0169	0.0099	1.70	0.099
ALLIGATORFISH	0	39	0.0039	0.0056	0.70	0.491	0.08	0.928	16	0.0010	0.0040	0.25	0.807
ARCTIC ALLIGATORFISH	0	27	-0.0996	0.0670	-1.49	0.149			27	-0.0996	0.0670	-1.49	0.149
ATL SEA POACHER	0	36	0.0066	0.0072	0.92	0.362	3.46	0.052	20	0.0031	0.0057	0.54	0.592
THREESPINE STICKLEBACK	0	12	0.0060	0.0073	0.82	0.427			12	0.0060	0.0073	0.82	0.427
ATL SPINY LUMPSUCKER	0	24	0.0233	0.0198	1.18	0.250	0.29	0.796	2	0.0041	0.0116	0.35	0.761
DUSKY SEASNAIL	0	40	0.0011	0.0129	0.09	0.931							
NORTHERN SAND LANCE	0	10	-0.0042	0.0364	-0.12	0.910	4.46	**0.019**					
FISH DOCTOR	0	14	0.0996	0.0750	1.33	0.205							
LAVAL`S EELPOUT	0	47	0.0115	0.0090	1.29	0.204							
SNAKEBLENNY	0	19	0.0048	0.0099	0.49	0.631	1.22	0.324	16	0.0097	0.0072	1.34	0.199
DAUBED SHANNY	0	68	-0.0002	0.0048	-0.04	0.972	6.32	**0.007**					
4-LINE SNAKE BLENNY	0	26	-0.0154	0.0122	-1.26	0.219							
STOUT EELBLENNY	0	29	0.0074	0.0132	0.56	0.581							
OCEAN	0	7					4.58	**0.033**					

Species	outlier	1. September survey data only DF	β_{depth}	SE	t	P	2. Survey effect F	P	3. September & July data where appropriate DF	β_{depth}	SE	t	P
POUT(COMMON)													
VAHL'S EELPOUT	0	16	0.0004	0.0080	0.05	0.957	0.16	0.854	24	-0.0013	0.0050	-0.27	0.793
ATL HOOKEAR SCULPIN	0	35	0.0024	0.0080	0.31	0.761	0.67	0.653	2	0.0013	0.0068	0.19	0.865
ATL ROCK CRAB	0	15	-0.0060	0.0151	-0.40	0.697	1.39	0.348	5	-0.0143	0.0136	-1.05	0.342
Hyas coarctatus	0	72	-0.0039	0.0049	-0.78	0.436	6.16	**0.006**					
Hyas coarctatus	1	71	-0.0034	0.0046	-0.74	0.461	2.84	0.075	30	-0.0087	0.0045	-1.94	0.062
SNOW CRAB	0	90	0.0027	0.0020	1.33	0.185	4.80	**0.010**					
SNOW CRAB	1	90					7.16	**0.001**					
Hyas araneus	0	47	-0.0252	0.0162	-1.56	0.126	3.49	0.113	6	0.0004	0.0094	0.04	0.967
SHORT-FIN SQUID	0	23	-0.0077	0.0033	-2.36	**0.027**	0.01	0.989	61	-0.0001	0.0026	-0.02	0.980
SHORT-FIN SQUID	1	23					0.00	0.996	60	-0.0001	0.0026	-0.02	0.982

Table 14. Results of preliminary fixed effects model analyses, with set pairs having ≥20% difference in tow distance removed, testing for a diel difference in the relative catchability of the *CCGS Alfred Needler* and the *CCGS Teleost* based on (1) the September 2004 and 2005 comparative fishing experiments and (2) the combined September and July comparative fishing experiments. Probability values are based on 999 permutations under the null hypothesis.

	September				September and July			
Species	*N*	β_{diel}	*S.E.*	*P*	*N*	β_{diel}	*S.E.*	*P*
Cod	81	0.757	0.196	0.544	185	0.481	0.125	0.475
outlier removed	80	0.222	0.136	0.133	184	0.098	0.105	0.634
White hake	21	-0.029	0.192	0.892	35	-0.144	0.128	0.477
Redfish	24	-0.372	0.379	0.370	141	-0.100	0.135	0.623
Halibut	11	-0.647	3.754	0.514	50	0.361	0.409	0.484
Greenland halibut	38	0.331	0.473	0.620	70	0.344	0.151	0.289
American plaice	90	0.116	0.102	0.281	228	-0.048	0.062	0.611
Witch flounder	24	-0.193	0.668	0.692	120	0.064	0.136	0.821
Yellowtail flounder	37	-0.080	0.355	0.827	108	-0.059	0.113	0.814
Winter flounder	19	0.435	0.630	0.556	49	0.333	0.200	0.547
Herring	56	0.557	0.360	0.545	155	0.679	0.207	0.302
outlier removed	55	0.772	0.677	0.280	154	0.854	0.176	0.137
Capelin	59	-0.348	0.225	0.742	87	-0.175	0.179	0.820
outlier removed	58	0.240	0.318	0.469	86	0.249	0.150	0.359
Mackerel	18	-2.124	4.896	0.299	24	-1.348	0.992	0.478
Longfin hake					28	-1.363	0.592	0.059
Fourbeard rockling	18	1.322	0.746	0.337	42	0.465	0.489	0.546
Greenland cod	26	1.560	0.808	0.061				
Thorny skate	22	-0.359	0.374	0.313	98	0.141	0.200	0.590
Smooth skate	11	-0.241	0.443	0.562	47	0.034	0.406	0.952
Winter skate					17	-0.513	1.058	0.708
Spiny dogfish					31	-0.199	0.149	0.426
Atlantic hagfish	12	-0.236	0.852	0.837	41	0.127	0.492	0.838
Longhorn sculpin	19	0.548	0.679	0.743	97	-0.171	0.250	0.659
Shorthorn sculpin	31	-0.283	0.653	0.765	38	-0.240	0.514	0.796
Arctic staghorn sculpin	32	-1.293	1.222	0.769				
Moustache sculpin	50	1.394	0.480	0.173	101	1.236	0.457	0.058
Arctic hookear sculpin	21	-0.169	4.024	0.956				
Atl hookear sculpin	33	0.141	2.059	0.905				
Hookear sculpins,ns	39	0.071	1.034	0.965	68	0.427	0.622	0.766
Spatulate sculpin	39	-0.329	0.521	0.574				
Sea raven	13	-0.864	0.817	0.437	71	**-1.001**	**0.210**	**0.044**
outlier removed		as above			70	**-0.759**	**0.256**	**0.026**
Alligatorfish	39	-0.813	0.393	0.078	91	-0.251	0.229	0.439
Arctic alligatorfish	27	0.445	0.877	0.773				

Species	September				September and July			
	N	β_{diel}	S.E.	P	N	β_{diel}	S.E.	P
Alligatorfishes, n.s.	53	-0.202	0.494	0.820				
Atl sea poacher	37	0.434	0.329	0.160	59	0.389	0.182	0.120
M.-s. grenadier	8	0.932	7.138	0.302	23	0.678	0.297	0.155
Spiny lumpsucker	24	-0.384	2.572	0.768	49	-0.418	0.574	0.661
Dusky seasnail	39	-0.525	0.471	0.592	48	-0.456	0.307	0.620
outlier removed	38	-1.107	0.563	0.054	47	-1.026	0.417	0.055
Sand lance	11	-1.535	2.049	0.743	53	-0.197	0.065	0.631
Laval`s eelpout	44	-0.067	0.439	0.911				
Snakeblenny	21	**2.141**	**0.708**	**0.016**	44	0.202	0.245	0.632
Daubed shanny	66	0.228	0.240	0.401	95	0.041	0.047	0.854
4-line snake blenny	25	-0.730	0.785	0.467				
Stout eelblenny	29	0.064	0.252	0.770				
Ocean pout	9	25.585	8.768	0.942	37	-0.094	0.333	0.886
Shanny-n.s.	66	0.006	0.120	0.974				
outliers removed	63	-0.140	0.130	0.271				
Vahl's eelpout	18	0.372	0.480	0.862	46	0.289	0.164	0.532
outlier removed	17	-0.591	0.373	0.085	45	-0.069	0.271	0.847
White barracudina	7	0.153	5.747	0.692	19	1.563	0.217	0.195
Atlantic rock crab	16	-0.196	0.456	0.636	37	-0.703	0.257	0.496
outlier removed	15	-0.093	0.513	0.867	36	-0.209	0.386	0.651
Hyas coarctatus	68	0.167	0.271	0.641	125	0.277	0.083	0.339
outliers removed	67	0.318	0.323	0.356	122	0.370	0.170	0.117
Northern stone crab	11	1.249	8.369	0.567	41	0.396	0.383	0.435
Snow crab	85	0.230	0.269	0.413	172	-0.020	0.034	0.929
outlier removed			as above		171	0.080	0.116	0.663
Hyas araneus	44	-0.115	1.146	0.870	85	0.113	0.190	0.904
outliers removed			as above		83	0.476	0.361	0.454
Short-fin squid	24	-0.655	1.290	0.422	129	0.229	0.081	0.548
outlier removed			as above		128	0.389	0.178	0.280

Table 15. Results of (1.) fixed and (2.) mixed effects model analyses testing for a difference in the catchability of certain invertebrate taxa between the *CCGS Alfred Needler* and the *CCGS Teleost*. Analyses are based on the September 2004 and 2005 comparative fishing experiments, with set pairs having ≥20% difference in tow distance removed. The column *outlier* indicates whether the analysis is based on all available data (0), removing outliers only (1), removing only sets in which much unsorted remaining catch was reported (2) removing outliers and sets with unsorted catch (3). Probability values are based on 999 permutations under the null hypothesis in (1) and represent the probability value for the *t*-statistic (2.).

			1. Fixed-effects model analysis				*2. Mixed-effects model analysis*			
species	**outlier**	**DF**	β_v	**SE**	***F***	P_{rand}	β_v	**SE**	***F***	***P***
Whelk eggs	0	53	-0.313	0.426	0.45	0.512	-0.313	0.426	0.54	0.466
	1	52	-0.426	0.419	1.18	0.293	-0.426	0.419	1.03	0.314
	2	46	-0.148	0.439	0.10	0.766	-0.148	0.439	0.11	0.738
	3	45	-0.275	0.430	0.55	0.483	-0.275	0.430	0.41	0.526
Sea potato	0	64	-0.602	0.437	0.63	0.438	-0.602	0.437	1.90	0.173
	1	62	-0.773	0.411	2.85	0.104	-0.773	0.411	3.53	0.065
	2	48	-0.213	0.483	0.00	0.997	-0.213	0.483	0.19	0.662
	3	46	-0.425	0.443	0.66	0.421	-0.425	0.443	0.92	0.342
Shrimp	0	88	-0.806	0.253	0.67	0.414	-0.806	0.253	10.15	**0.002**
	1	86	-0.827	0.258	0.87	0.332	-0.827	0.258	10.31	**0.002**
	2	78	-0.292	0.219	0.83	0.372	-0.292	0.219	1.77	0.187
	3	76	-0.302	0.224	0.75	0.408	-0.302	0.224	1.83	0.181
Hermit crabs	0	67	-0.459	0.326	2.51	0.103	-0.459	0.326	1.98	0.164
	2	52	-0.294	0.287	1.62	0.222	-0.294	0.287	1.05	0.310
Polycheates	0	51	-0.920	0.175	35.70	**<0.001**	-0.920	0.175	27.72	**<0.001**
	1	49	-1.055	0.153	52.65	**<0.001**	-1.055	0.153	47.58	**<0.001**
	2	30	-0.655	0.252	8.04	**0.010**	-0.655	0.252	6.73	**0.015**
	3	28	-0.868	0.218	14.73	**<0.001**	-0.868	0.218	15.89	**0.000**
Sea mouse	0	12	-0.329	0.922	0.07	0.788	-0.329	0.922	0.13	0.728
	2	10	-0.350	0.974	0.07	0.806	-0.350	0.974	0.13	0.727
Mollusk shells	0	86	-0.606	0.205	9.88	**0.003**	-0.606	0.205	8.73	**0.004**
	1	85	-0.631	0.206	11.38	**0.003**	-0.631	0.206	9.36	**0.003**
	2	79	-0.590	0.171	13.10	**0.003**	-0.590	0.171	11.91	**0.001**
	3	78	-0.616	0.171	15.56	**<0.001**	-0.616	0.171	12.99	**0.001**
Whelks	0	69	-0.343	0.256	1.90	0.167	-0.343	0.256	1.79	0.185
	1	68	-0.373	0.258	2.47	0.130	-0.373	0.258	2.10	0.152
	2	63	-0.176	0.226	0.68	0.408	-0.176	0.226	0.61	0.439
	3	62	-0.207	0.227	1.10	0.286	-0.207	0.227	0.83	0.367
Iceland scallop	0	19	-0.906	0.756	1.58	0.243	-0.906	0.756	1.44	0.246
	1	18	-1.249	0.711	3.50	0.085	-1.249	0.711	3.09	0.096
	2	13	-1.995	0.673	10.03	**0.016**	-1.995	0.673	8.80	**0.011**
Octopus	0	14	-0.091	0.633	0.00	0.997	-0.091	0.633	0.02	0.888
	2	13	0.204	0.602	0.25	0.609	0.204	0.602	0.11	0.740

species	outlier	DF	1. Fixed-effects model analysis				2. Mixed-effects model analysis			
			β_v	SE	*F*	P_{rand}	β_v	SE	*F*	*P*
Starfish	0	70	0.124	0.371	0.14	0.703	0.124	0.371	0.11	0.740
	1	67	0.141	0.345	0.22	0.646	0.141	0.345	0.17	0.684
	2	56	0.204	0.366	0.28	0.605	0.204	0.366	0.31	0.580
	3	54	0.387	0.347	1.60	0.229	0.387	0.347	1.24	0.270
Mud star	0	29	-0.254	0.507	0.30	0.549	-0.254	0.507	0.25	0.620
	2	23	0.317	0.558	0.32	0.598	0.317	0.558	0.32	0.576
Sunstars	0	79	-0.465	0.243	5.29	**0.026**	-0.465	0.243	3.65	0.060
	2	74	-0.206	0.203	2.40	0.131	-0.206	0.203	1.03	0.314
Brittle stars	0	38	-2.655	0.439	22.84	**<0.001**	-2.655	0.439	36.62	**<0.001**
	1	37	-2.498	0.421	22.45	**<0.001**	-2.498	0.421	35.26	**<0.001**
	2	26	-2.496	0.574	10.60	**0.002**	-2.496	0.574	18.93	**<0.001**
	3	25	-2.261	0.544	9.40	**0.005**	-2.261	0.544	17.28	**<0.001**
Basket stars	0	67	-0.487	0.369	3.10	0.098	-0.487	0.369	1.74	0.192
	2	61	-0.571	0.340	3.95	0.054	-0.571	0.340	2.81	0.099
Sea urchins	0	83	-0.248	0.217	0.38	0.542	-0.248	0.217	1.30	0.257
	2	80	-0.206	0.203	0.24	0.639	-0.206	0.203	1.02	0.315
Sand dollars	0	48	-0.155	0.344	1.18	0.279	-0.155	0.344	0.20	0.655
	1	47	-0.102	0.347	0.58	0.445	-0.102	0.347	0.09	0.769
	2	44	-0.018	0.342	0.62	0.450	-0.018	0.342	0.00	0.958
	3	43	0.042	0.344	0.18	0.676	0.042	0.344	0.01	0.904
Sea cucumbers	0	25	-0.477	0.794	0.81	0.394	-0.477	0.794	0.36	0.553
	1	24	-0.521	0.826	1.05	0.308	-0.521	0.826	0.40	0.534
	2	19	-0.385	0.715	0.68	0.370	-0.385	0.715	0.29	0.596
	3	18	-0.437	0.751	1.01	0.347	-0.437	0.751	0.34	0.568
Sea anemones	0	75	0.081	0.338	0.04	0.836	0.081	0.338	0.06	0.811
	1	74	-0.029	0.324	0.05	0.806	-0.029	0.324	0.01	0.929
	2	61	0.215	0.317	0.39	0.523	0.215	0.317	0.46	0.499
Sea pen	0	11	-0.783	0.848	2.25	0.145	-0.783	0.848	0.85	0.375
Sea cauliflower	0	50	-0.983	0.334	9.52	**0.004**	-0.983	0.334	8.65	**0.005**
	2	40	-0.706	0.345	4.88	**0.043**	-0.706	0.345	4.18	**0.048**
Jellyfish	0	25	1.348	1.037	1.52	0.228	1.348	1.037	1.69	0.206
	2	18	1.399	1.117	1.18	0.308	1.399	1.117	1.57	0.226
Sponges	0	66	-0.939	0.504	3.62	0.066	-0.939	0.504	3.47	0.067
	2	56	-0.814	0.528	2.57	0.121	-0.814	0.528	2.38	0.129
Plants & algae	0	82	-1.119	0.358	6.46	**0.017**	-1.119	0.358	9.77	**0.002**
	1	81	-1.152	0.361	7.82	**0.009**	-1.152	0.361	10.18	**0.002**
	2	71	-0.799	0.354	2.88	0.094	-0.799	0.354	5.09	**0.027**
	3	70	-0.832	0.357	3.84	0.063	-0.832	0.357	5.42	**0.023**
Wood debris	0	67	-1.082	0.420	7.77	**0.002**	-1.082	0.420	6.62	**0.012**
	1	64	-1.200	0.430	9.60	**0.005**	-1.200	0.430	7.77	**0.007**
	2	49	-1.010	0.426	6.45	**0.011**	-1.010	0.426	5.61	**0.022**
	3	46	-1.168	0.436	8.96	**0.002**	-1.168	0.436	7.17	**0.010**

Table 16. Locations of stations sampled non-simultaneously by both the *Alfred Needler* (*N*) and *Teleost* (*T*) in 2004. Because these stations were not fished synchronously by both vessels, they were not included as part of the comparative fishing experiments but nonetheless constitute repeat sets for the regular survey sampling and therefore need to be weighted accordingly (see text section 4.2)

Stratum	*N* set #	*T* set #	latitude	longitude
432	5	5	45.5239	62.3815
402	3	6	45.5602	63.2006
402	2	7	46.0605	63.2385
432	4	10	45.5622	63.0356
433	6	12	45.5415	62.2456
403	7	16	45.4971	61.5001
403	9	18	45.4806	61.444
433	10	19	46.0501	61.4851
433	12	20	46.1289	61.5014
433	13	22	46.2265	61.5417
434	14	23	46.2572	61.4797
429	19	113	46.5947	62.4232
423	21	117	47.1639	62.2689
417	106	124	48.1002	63.5647
418	113	126	47.5509	64.539
419	110	127	47.535	65.2347
419	111	129	47.578	65.4563
418	108	132	48.0615	64.4768
417	105	134	48.2443	64.0522
416	104	136	48.2721	63.5269
416	103	137	48.381	63.5043
415	99	139	48.5268	63.4588
415	98	141	48.5089	63.3769
416	97	146	48.2781	63.3682
416	96	147	48.2247	63.4215
424	95	154	47.5629	63.0693
431	20	175	47.0413	62.2176
431	18	179	46.4609	62.2098
431	15	181	46.3335	62.1497
431	17	182	46.4184	62.1081

a)

b)

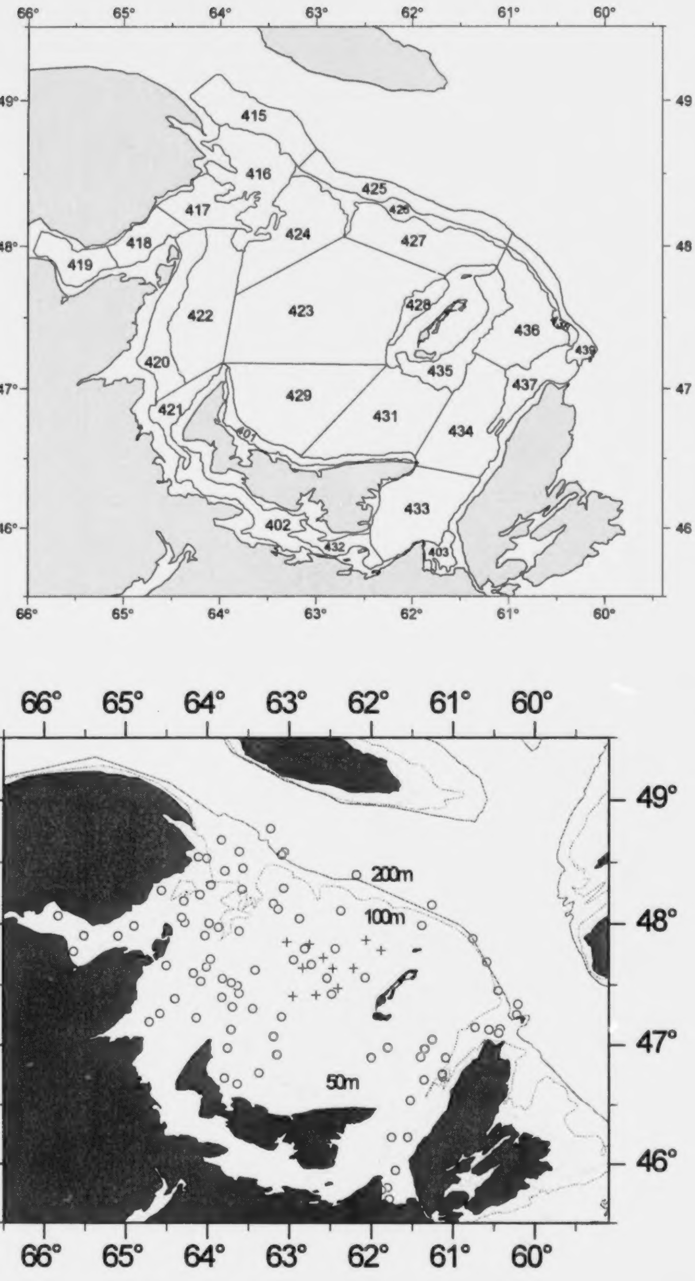

Figure 1. (a) Stratum boundaries for the southern Gulf of St. Lawrence September bottom-trawl survey, and (b) location of fishing sets in the 2004 (+) and 2005 (o) comparative fishing experiments.

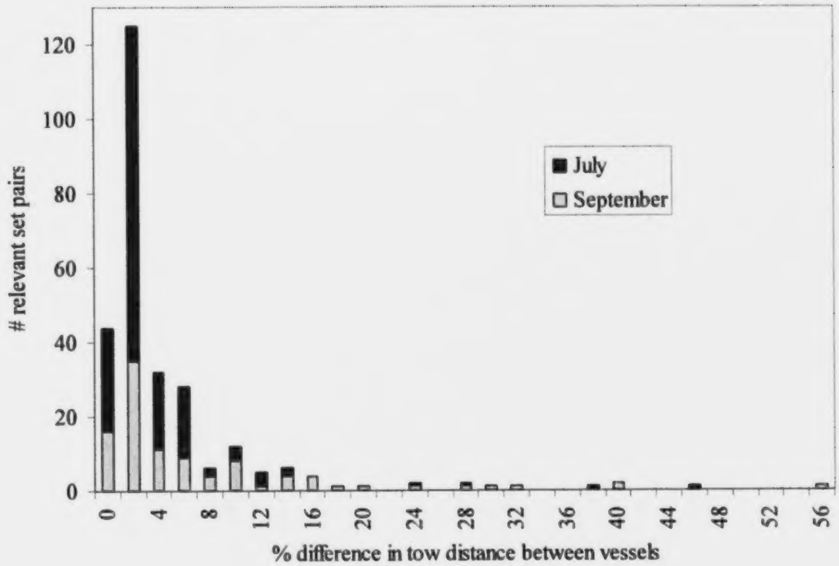

Figure 2. Histogram of the percentage difference in towing distance within relevant set pairs in the September and July comparative fishing experiments.

a)	b)	c)
d)	e)	f)
g)	h)	
i)	j)	k)
l)	m)	n)

Figure 3. The following general caption, describing the contents of each panel, applies to the individual species figures that follow.

<u>Data:</u>

a) Total standardized catches from paired sets by the Teleost vs. Alfred Needler from the September (o) and July (+) experiments. Dashed line is the 1:1 relationship.

b) Relative total length frequencies for Needler (solid line) & Teleost (dashed) in September.

c) Relative total length frequencies in the July experiments.

<u>Length-aggregated analysis</u>:

d) Histogram of standardized χ^2 residuals from the fixed-effects analysis.

e) Histogram of standardized χ^2 residuals from the mixed-effects analysis.

f) Histogram of random effects from the mixed-effects analysis.

<u>Analysis of length-dependent relative catchability:</u>

g) General additive model (GAM; with 95% confidence intervals) fit of standardized conditional χ^2 residuals from the fixed-effects analysis versus length.

h) Standardized total conditional χ^2 residuals from each set in the fixed-effects analysis.

i) Like panel (g), but for the mixed-effects analysis.

j) Like panel (h), but for the mixed-effects analysis.

k) Predicted random effects versus length for each set.

<u>Analysis of depth-dependent relative catchability:</u>

l) Standardized conditional χ^2 residuals from the fixed-effects analysis (+) along with GAM fit with 95% confidence intervals (lines) versus depth.

m) Like panel (l), but for the mixed-effects analysis.

n) Histogram of random effects from the mixed-effects analysis.

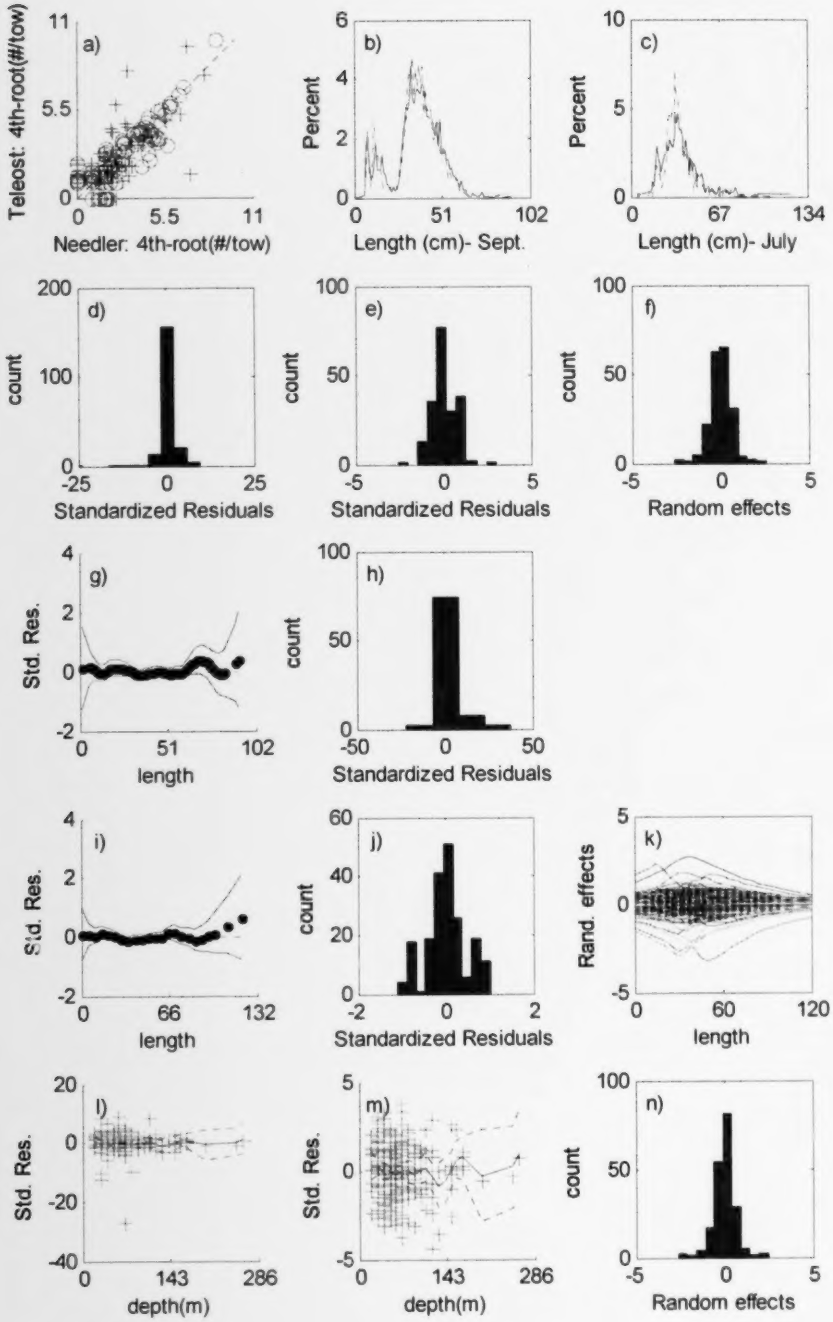

Figure 4. Comparative fishing analysis results for Atlantic cod (see Fig. 3 for details on the panel contents).

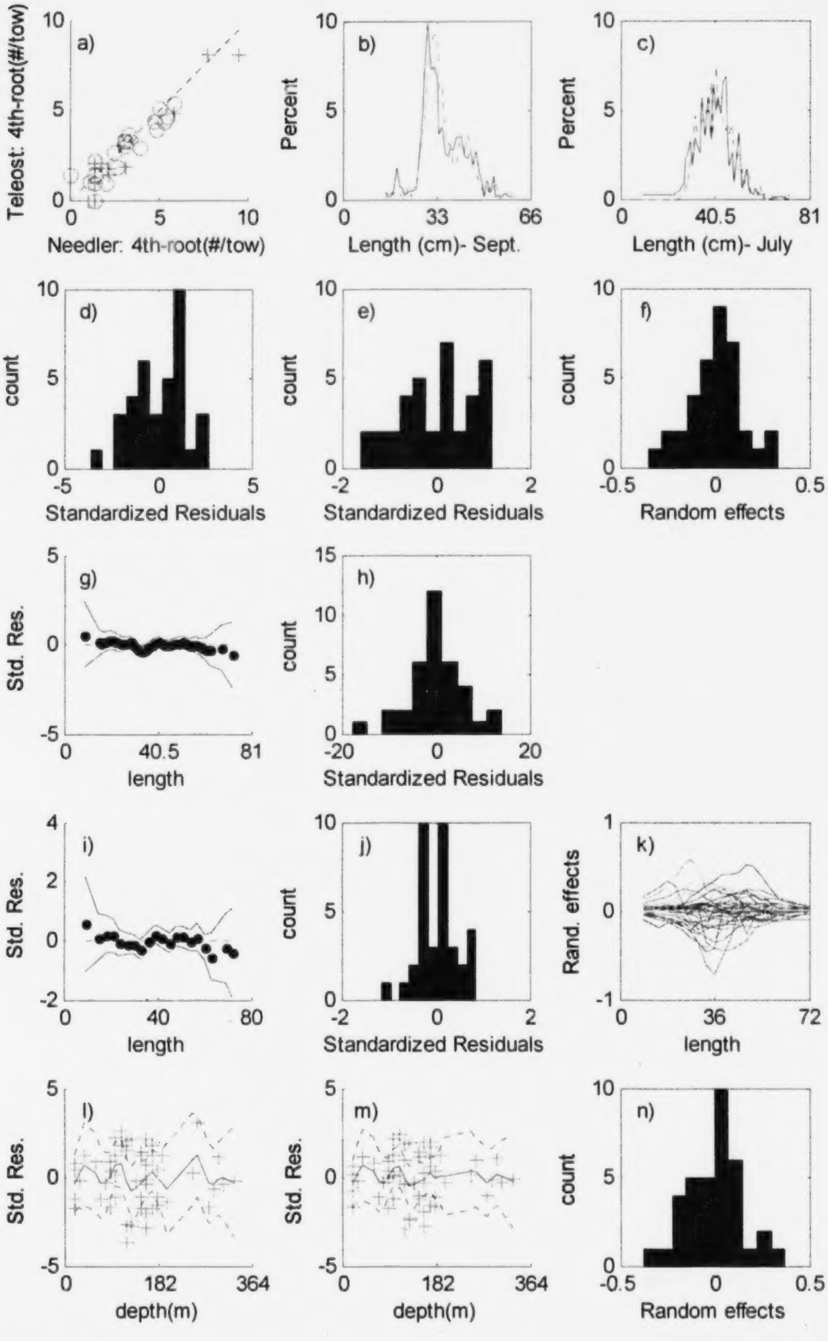

Figure 5. Comparative fishing analysis results for white hake (see Fig. 3 for details on the panel contents).

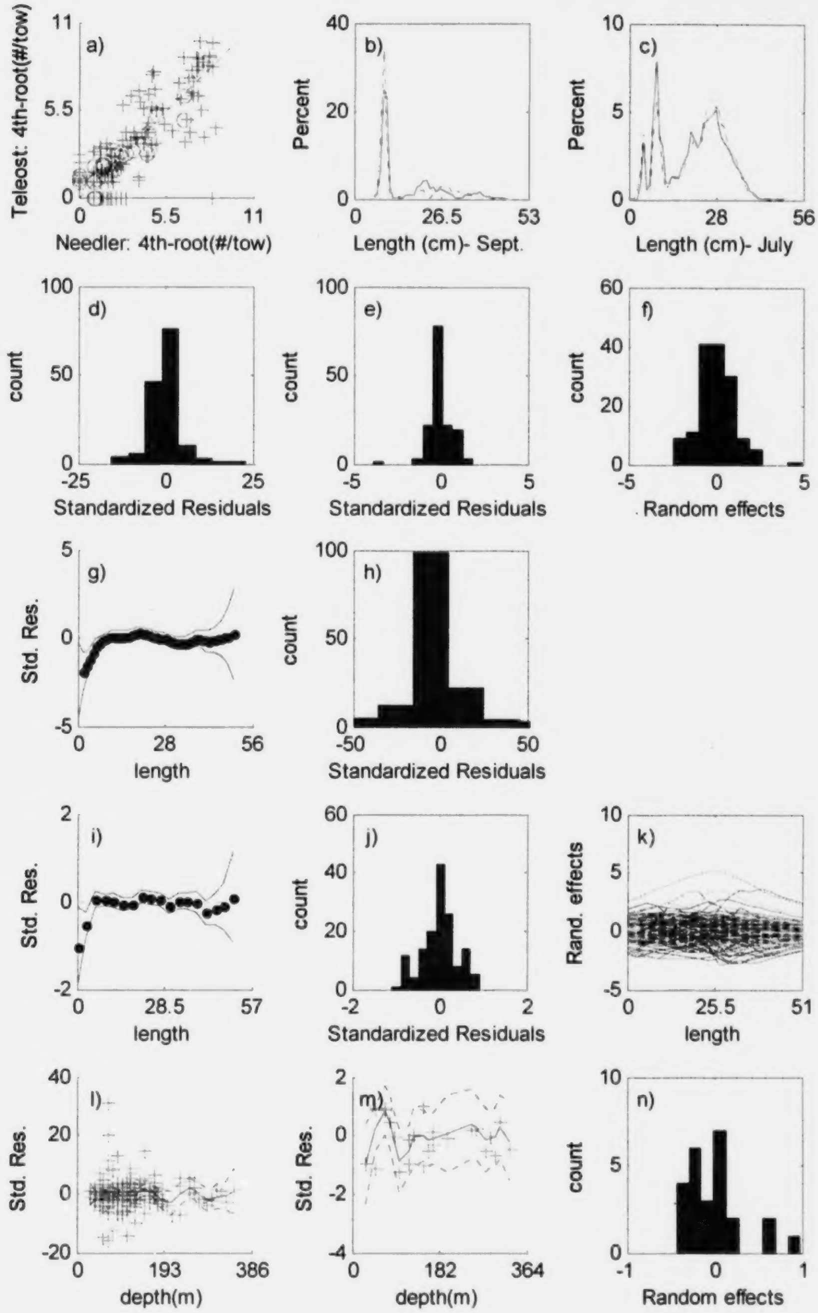

Figure 6. Comparative fishing analysis results for redfish (see Fig. 3 for details on the panel contents).

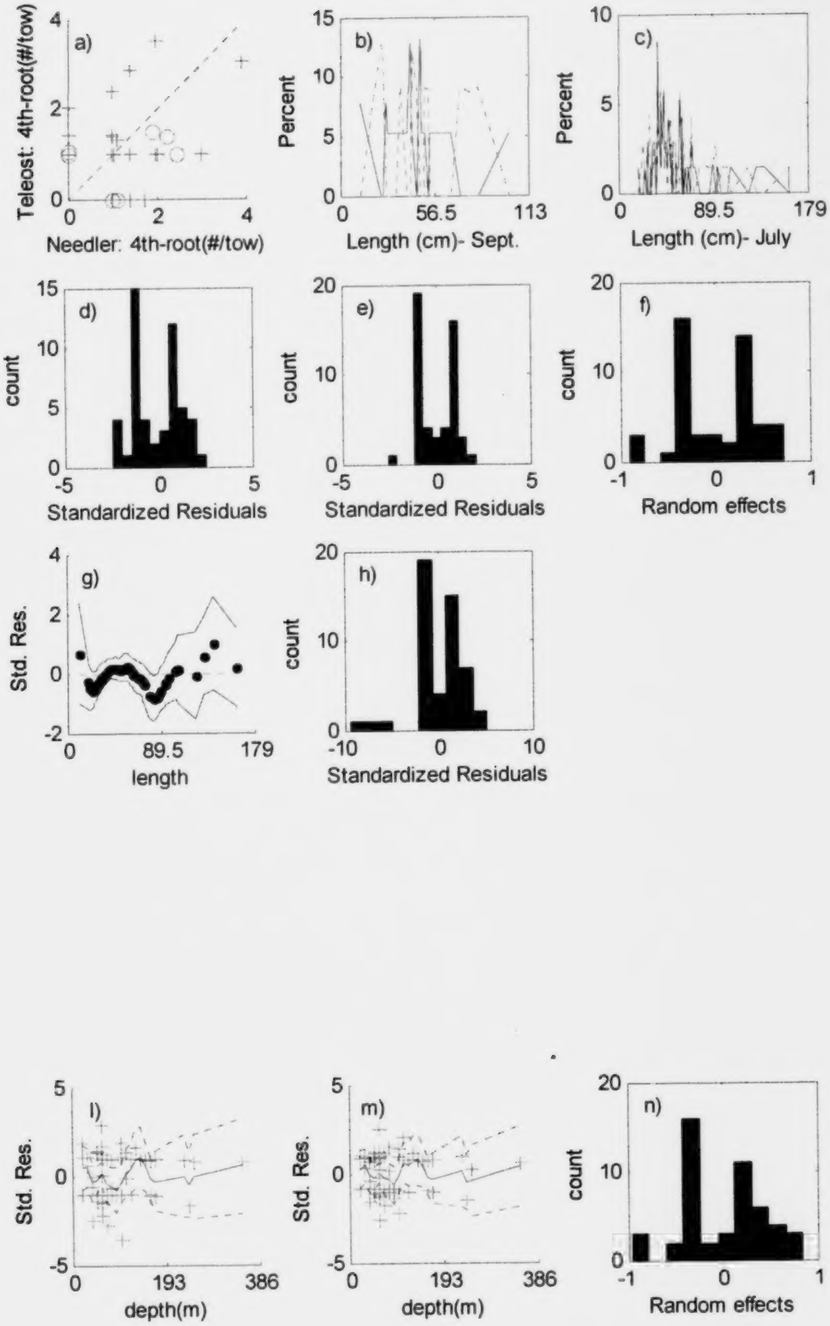

Figure 7. Comparative fishing analysis results for Atlantic halibut (see Fig. 3 for details on the panel contents).

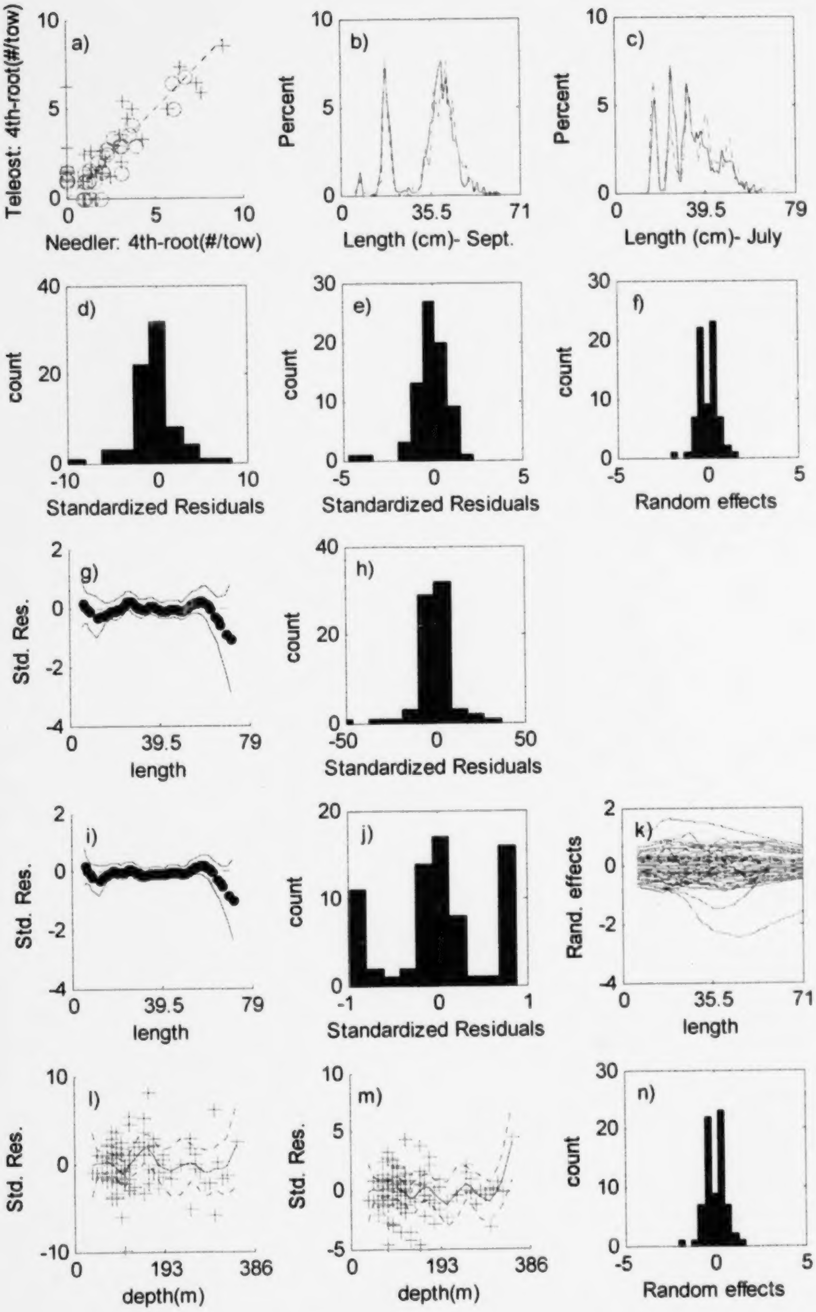

Figure 8. Comparative fishing analysis results for Greenland halibut (see Fig. 3 for details on the panel contents).

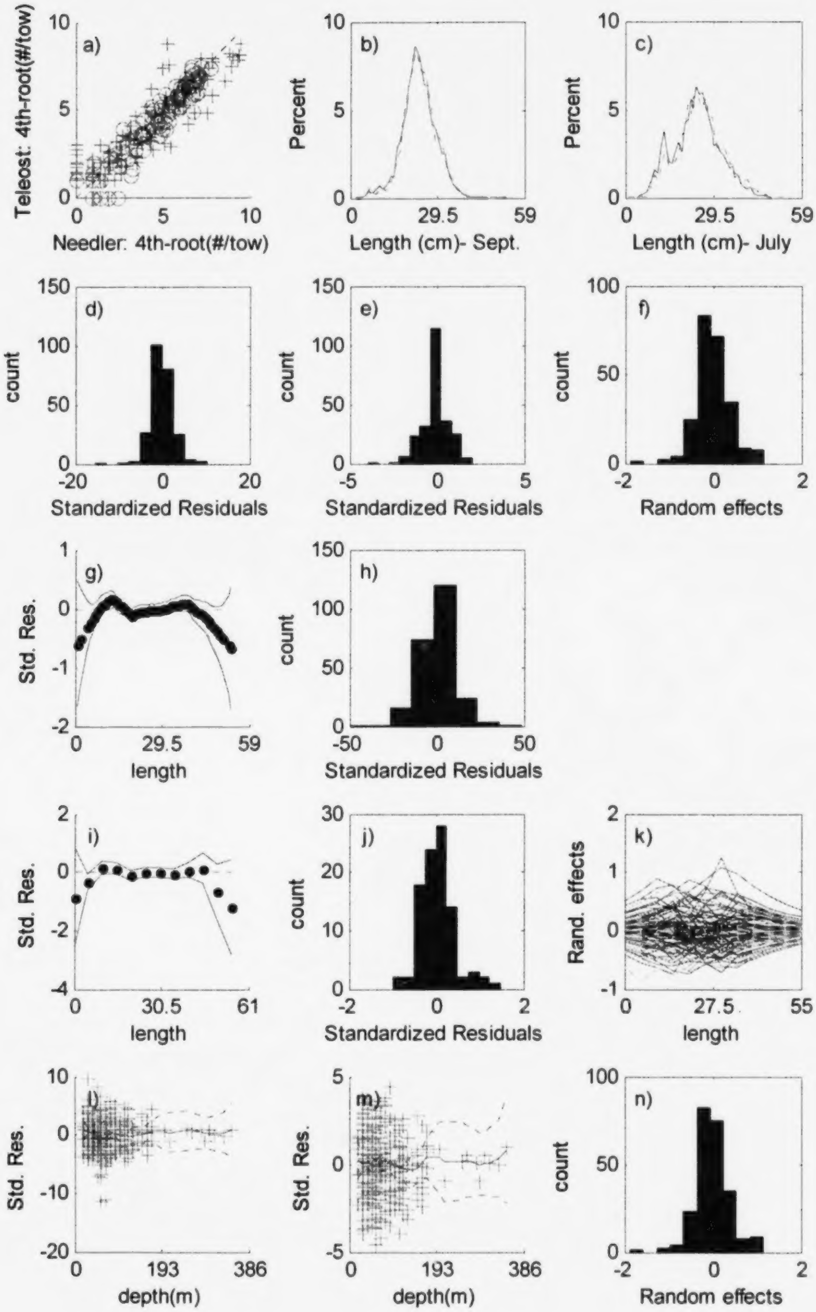

Figure 9. Comparative fishing analysis results for American plaice (see Fig. 3 for details on the panel contents).

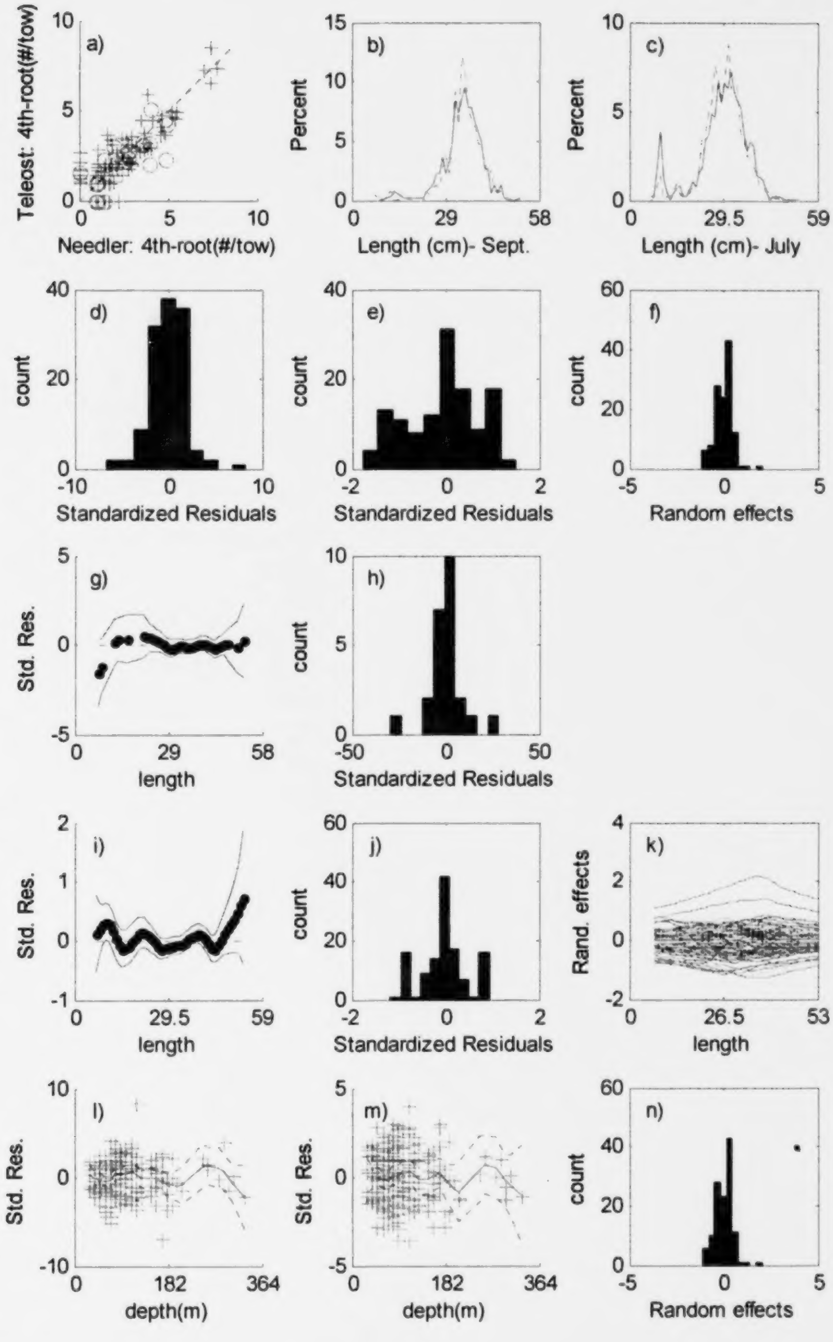

Figure 10. Comparative fishing analysis results for witch flounder (see Fig. 3 for details on the panel contents).

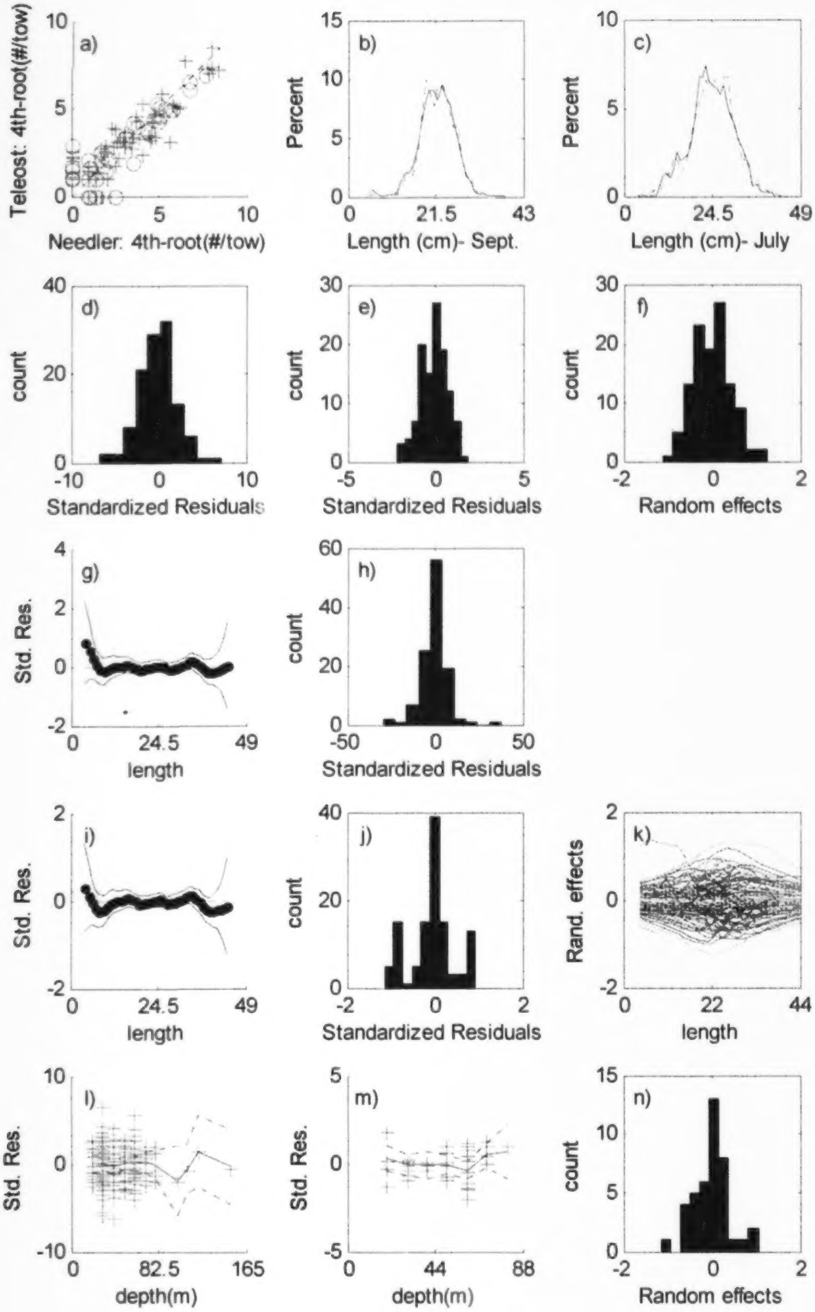

Figure 11. Comparative fishing analysis results for yellowtail flounder (see Fig. 3 for details on the panel contents).

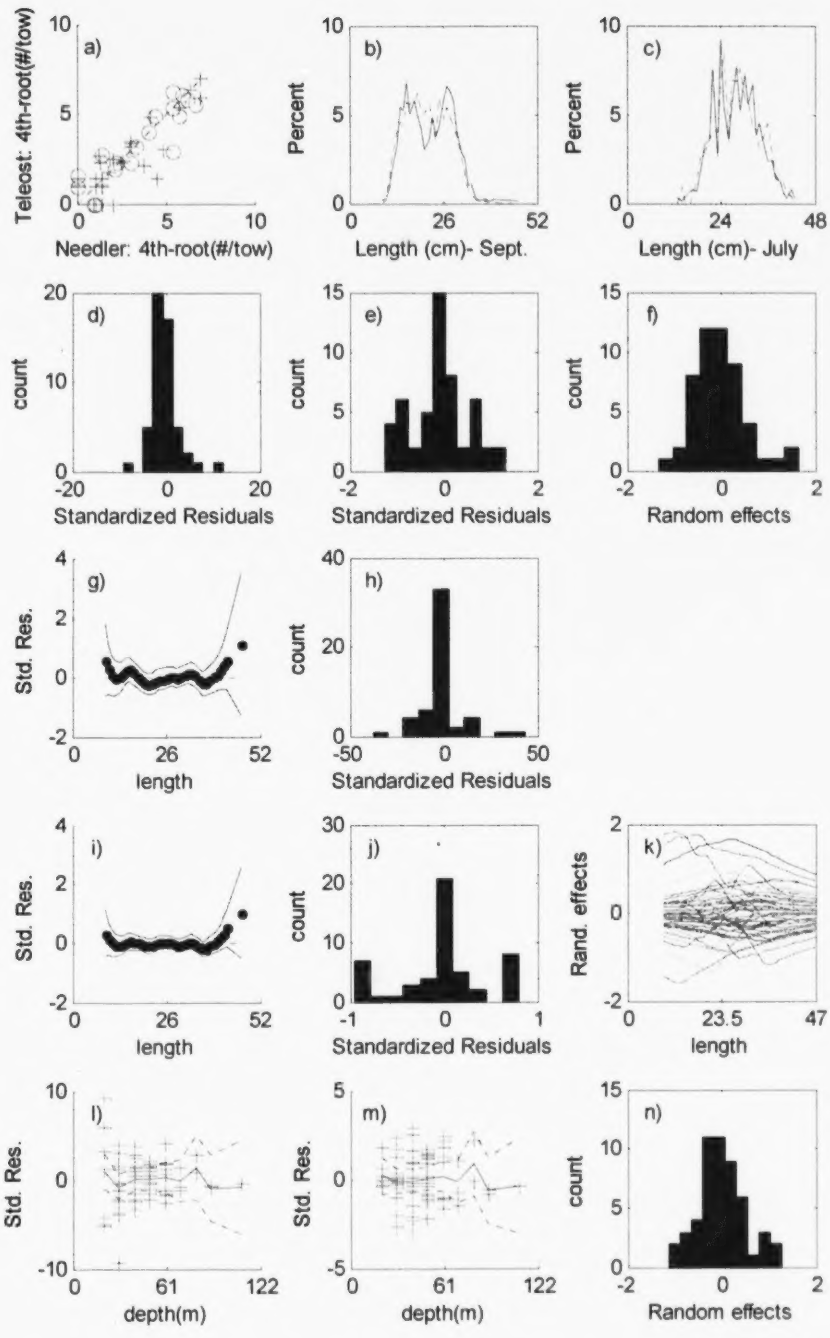

Figure 12. Comparative fishing analysis results for winter flounder (see Fig. 3 for details on the panel contents).

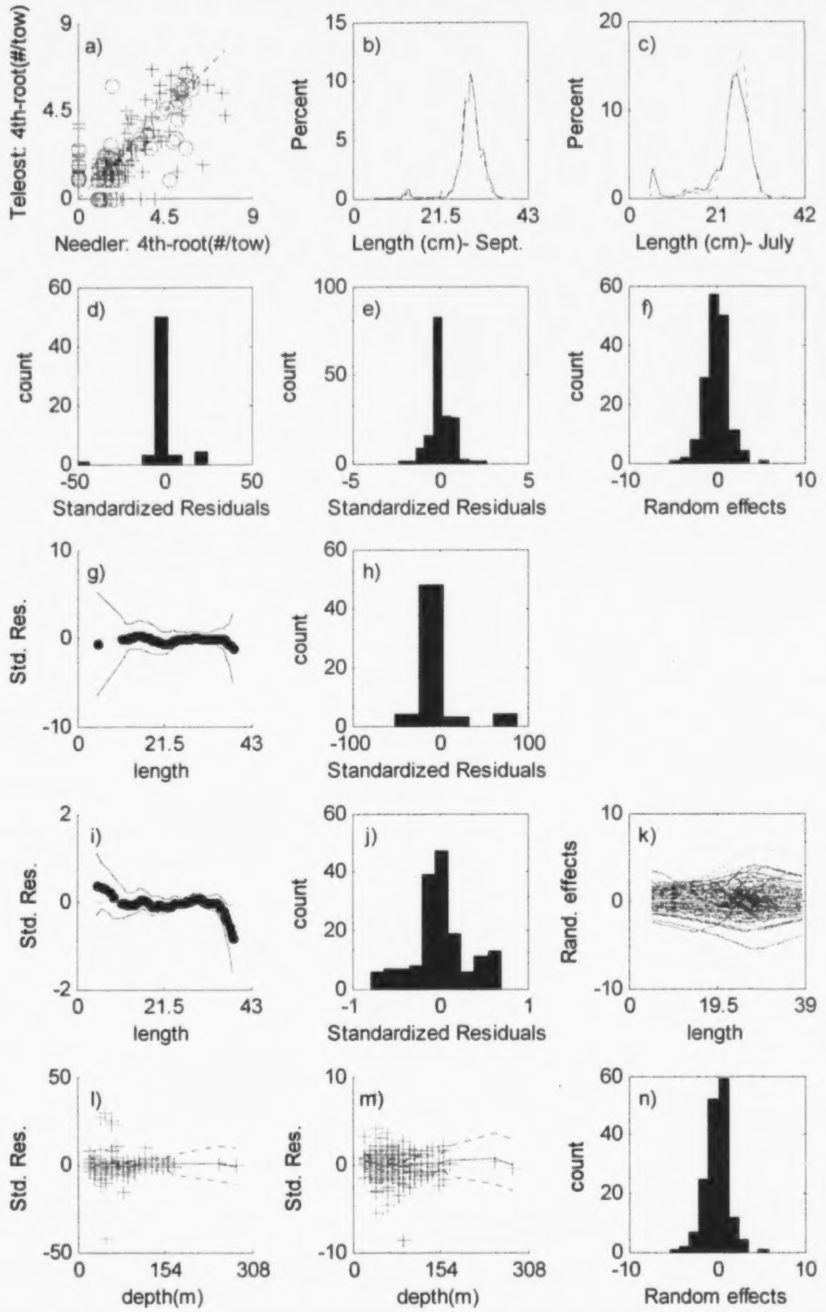

Figure 13. Comparative fishing analysis results for herring (see Fig. 3 for details on the panel contents).

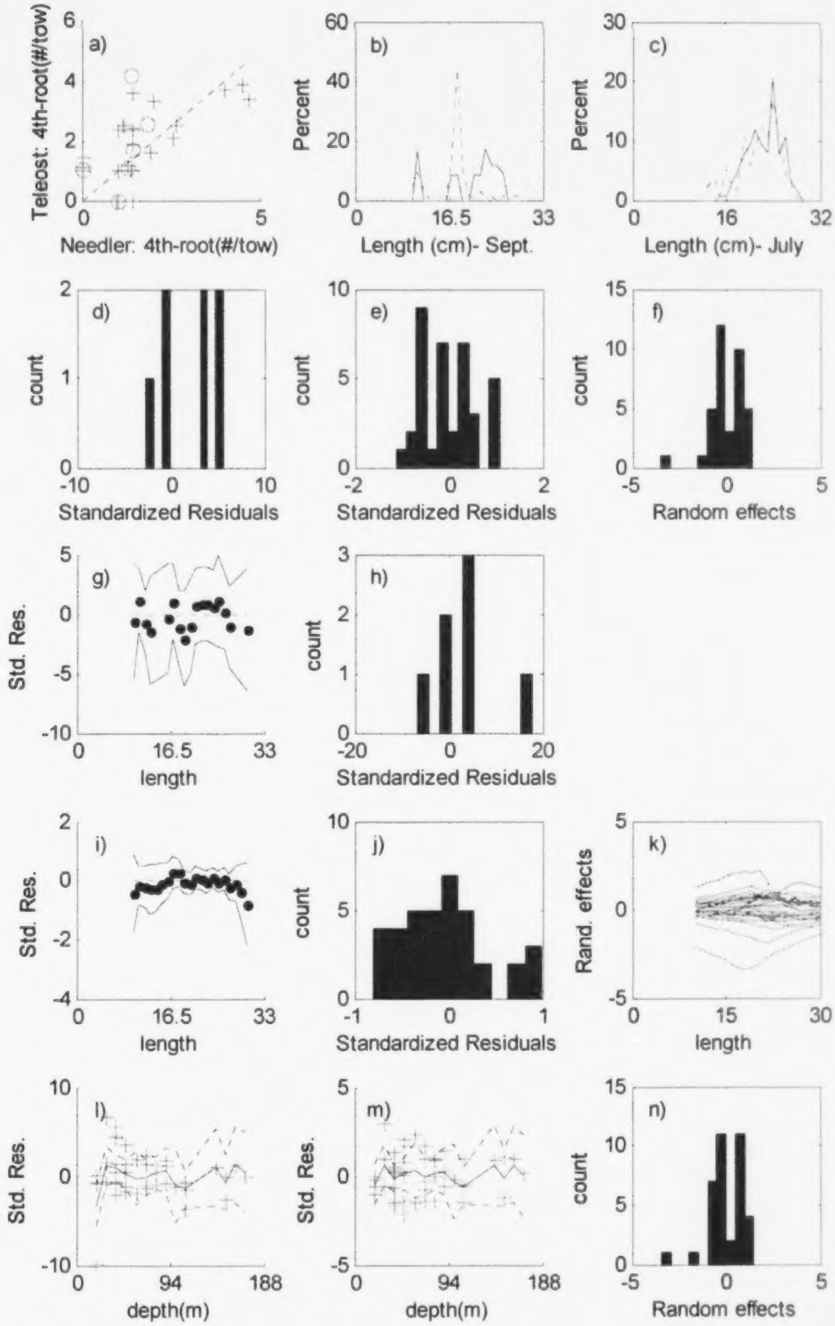

Figure 14. Comparative fishing analysis results for gaspereau (see Fig. 3 for details on the panel contents).

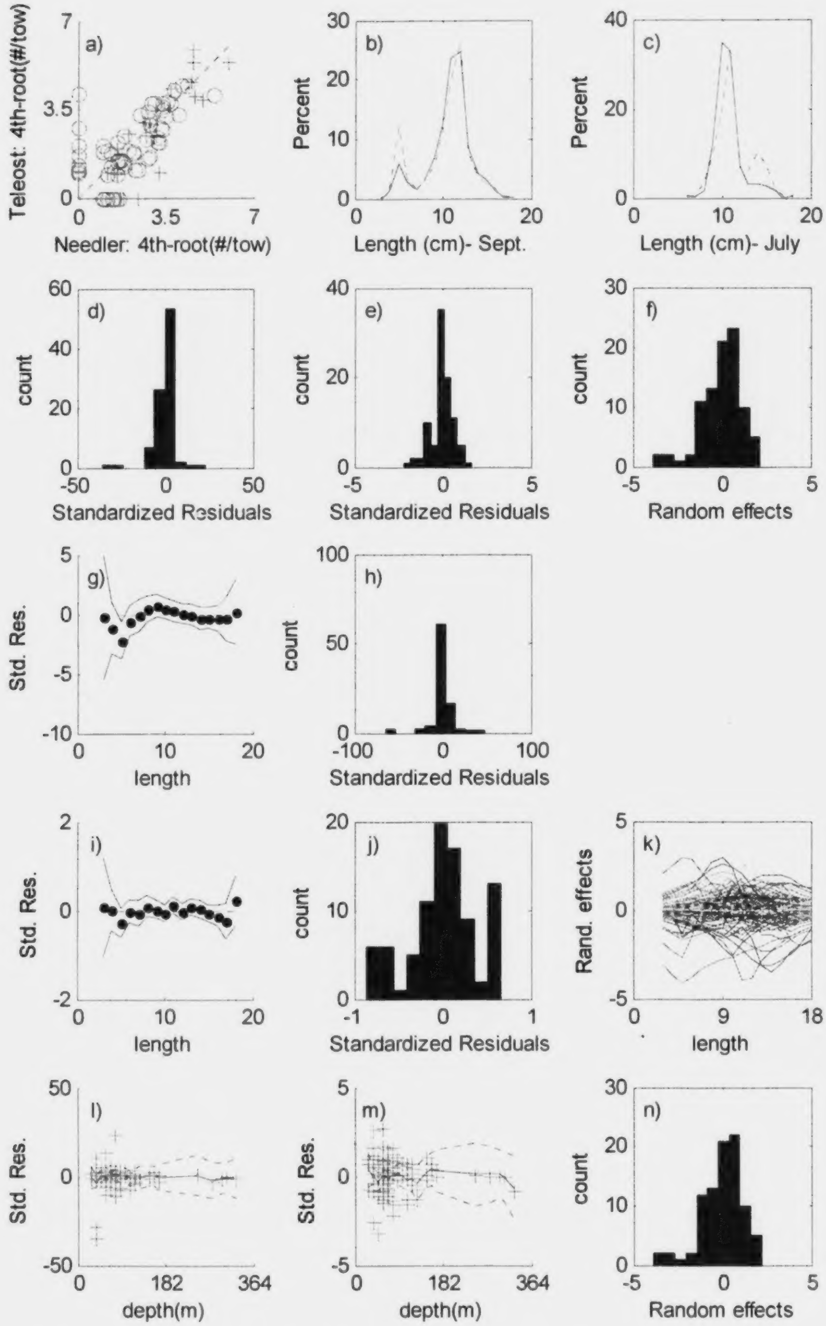

Figure 15. Comparative fishing analysis results for capelin (see Fig. 3 for details on the panel contents).

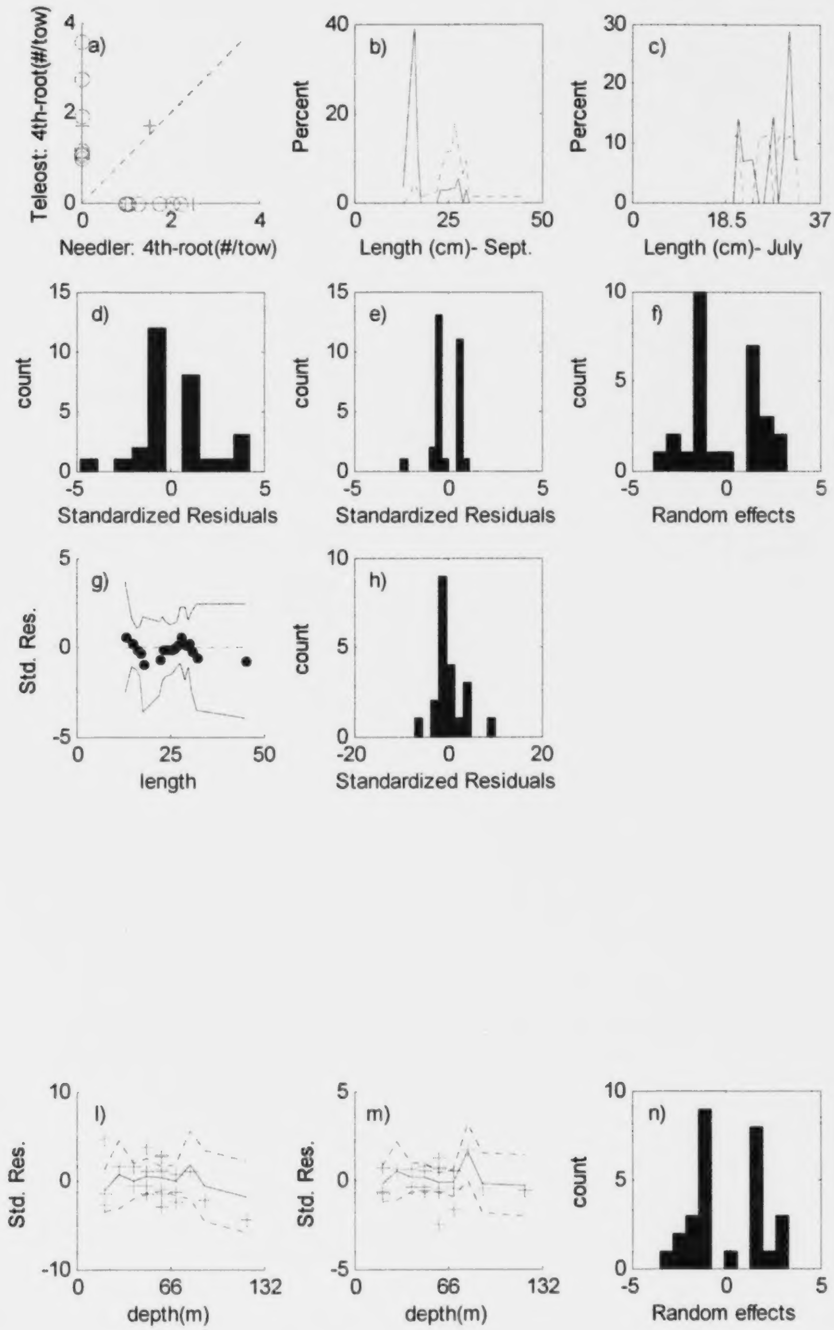

Figure 16. Comparative fishing analysis results for mackerel (see Fig. 3 for details on the panel contents).

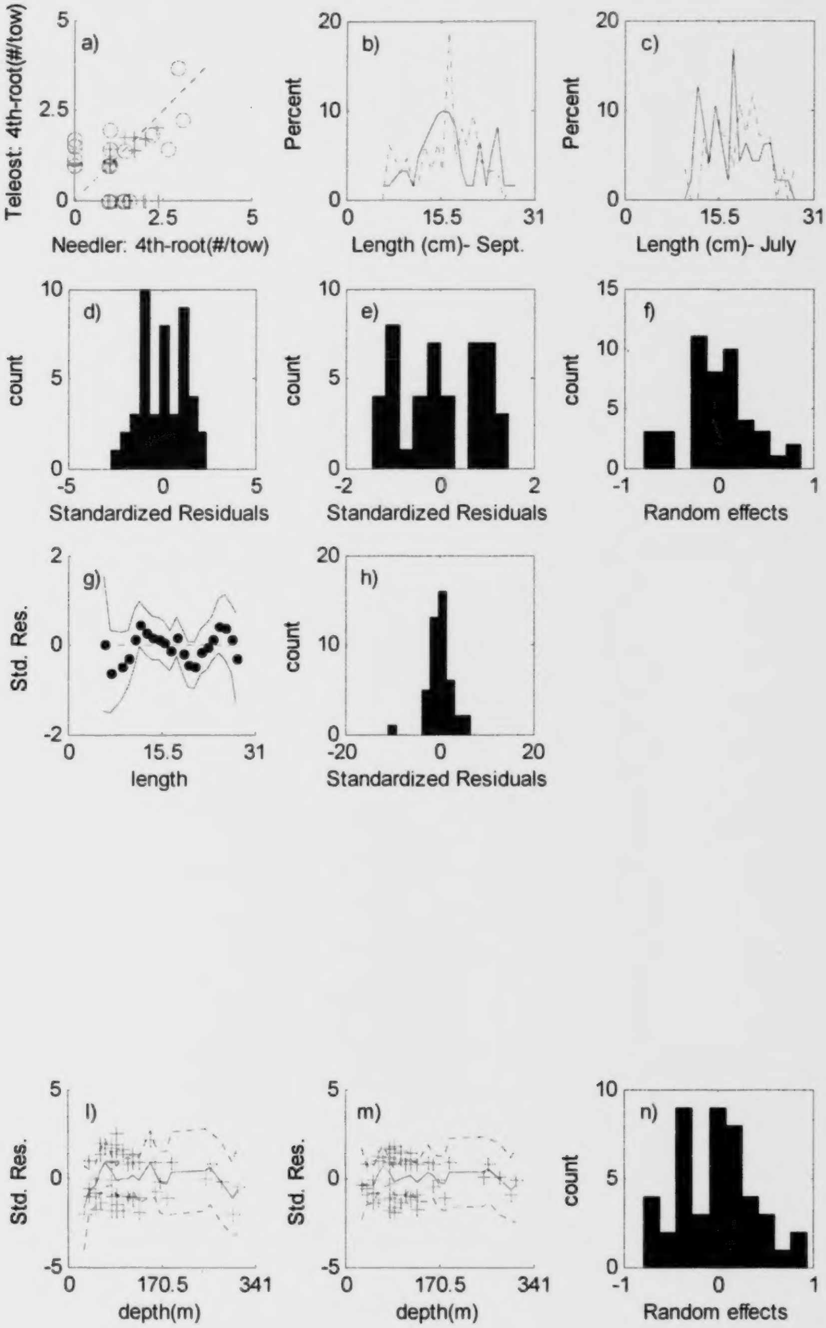

Figure 17. Comparative fishing analysis results for fourbeard rockling (see Fig. 3 for details on the panel contents).

Figure 18. Comparative fishing analysis results for Greenland cod (see Fig. 3 for details on the panel contents).

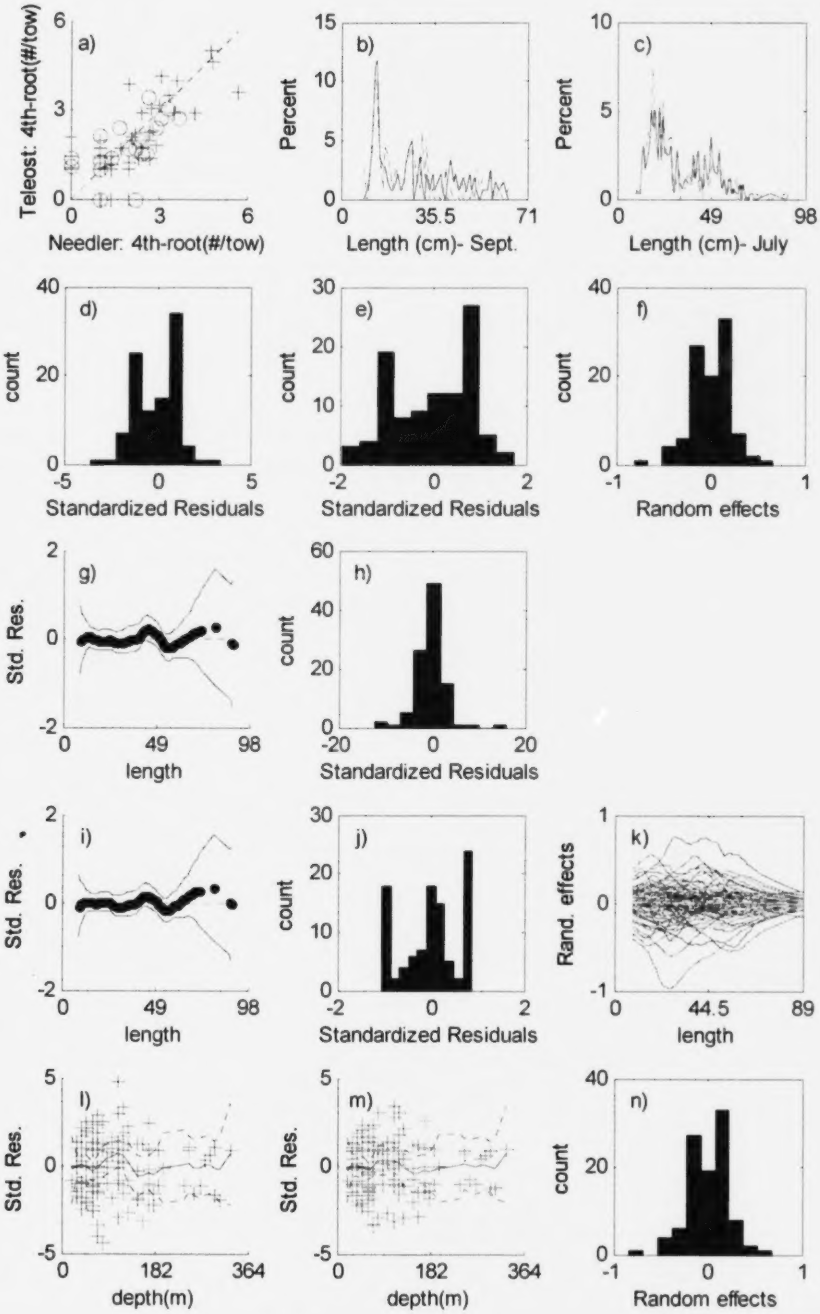

Figure 19. Comparative fishing analysis results for thorny skate (see Fig. 3 for details on the panel contents).

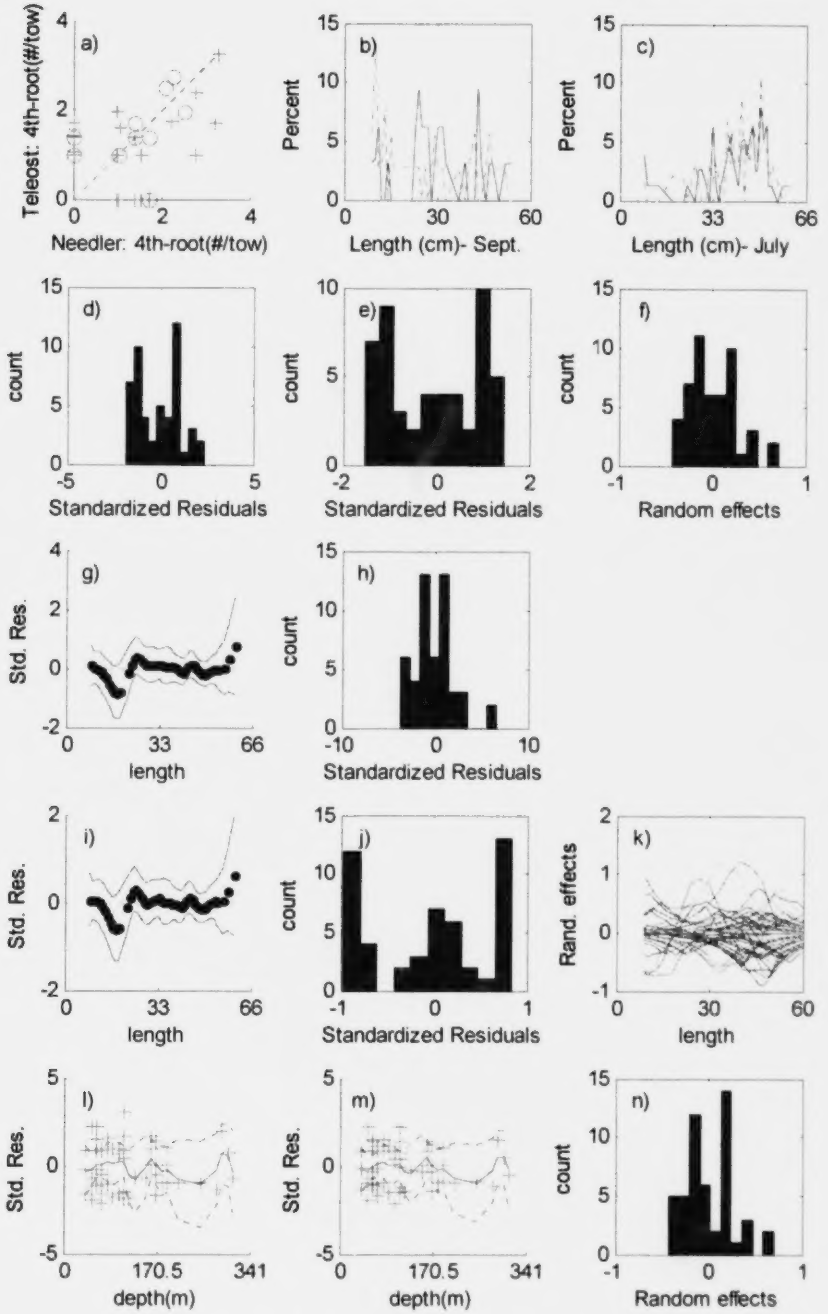

Figure 20. Comparative fishing analysis results for smooth skate (see Fig. 3 for details on the panel contents).

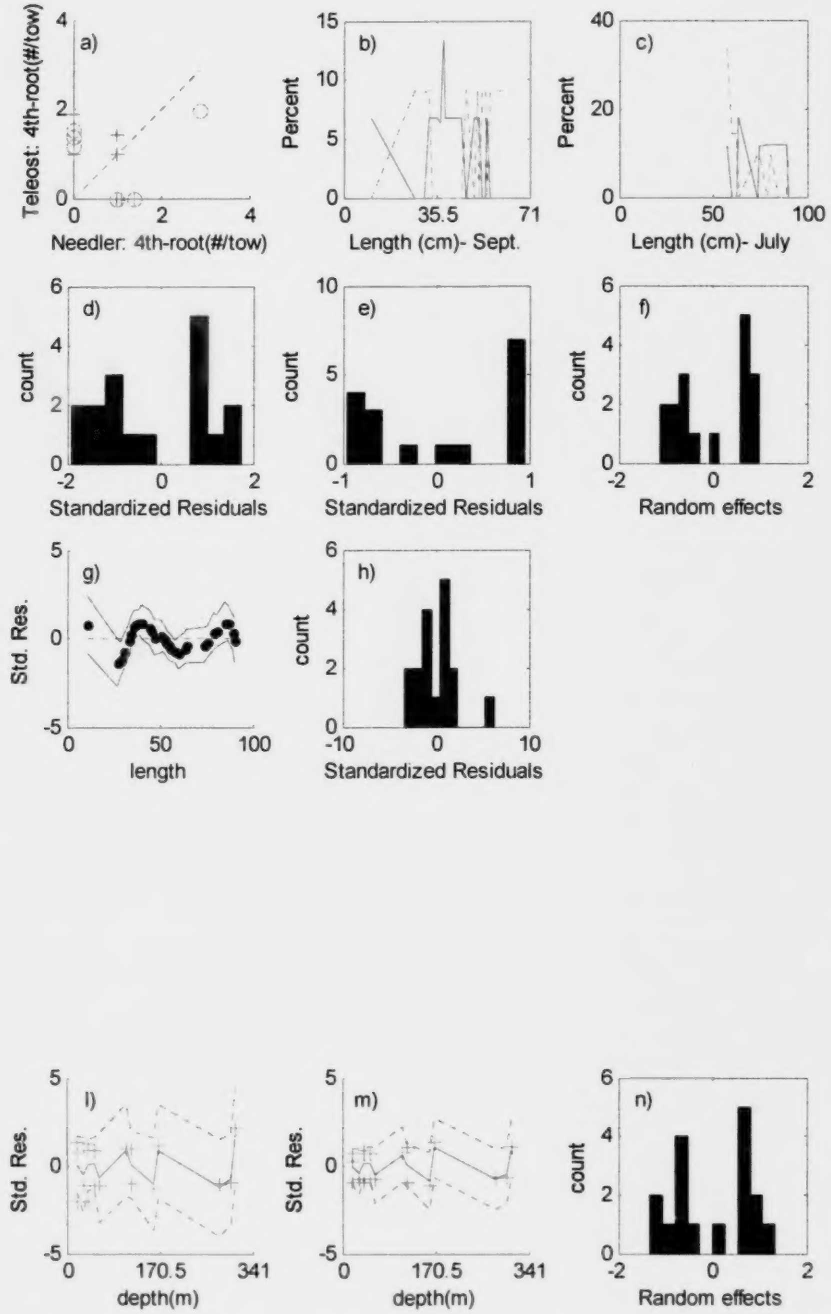

Figure 21. Comparative fishing analysis results for winter skate (see Fig. 3 for details on the panel contents).

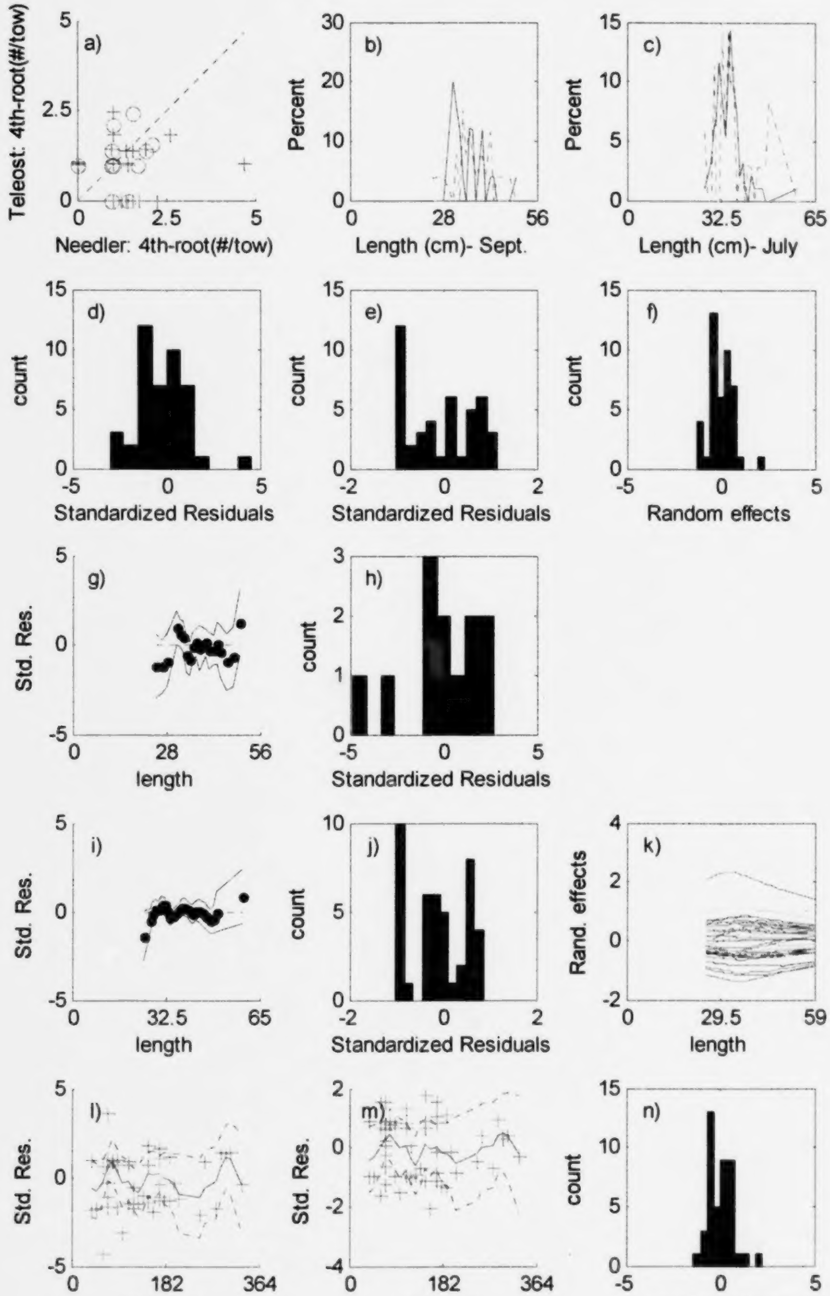

Figure 22. Comparative fishing analysis results for hagfish (see Fig. 3 for details on the panel contents).

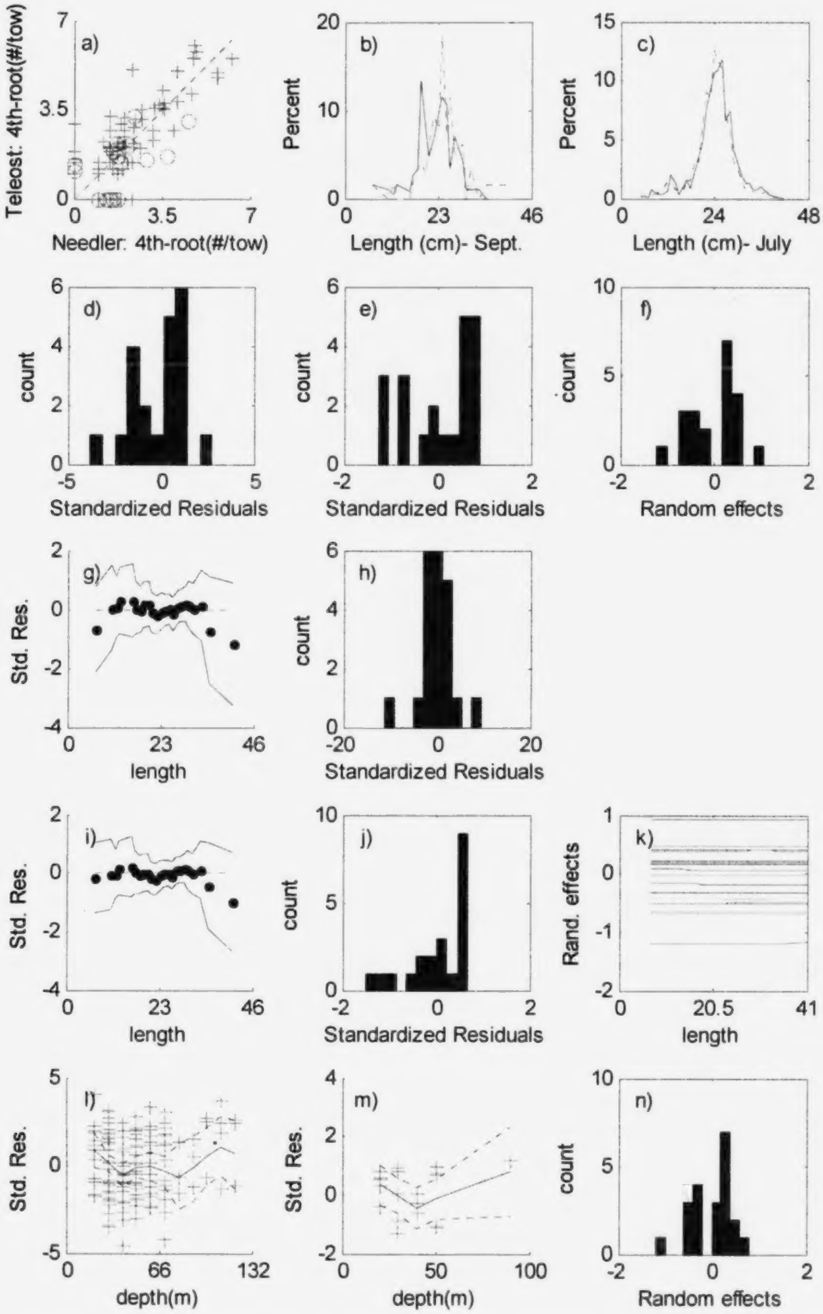

Figure 23. Comparative fishing analysis results for longhorn sculpin (see Fig. 3 for details on the panel contents).

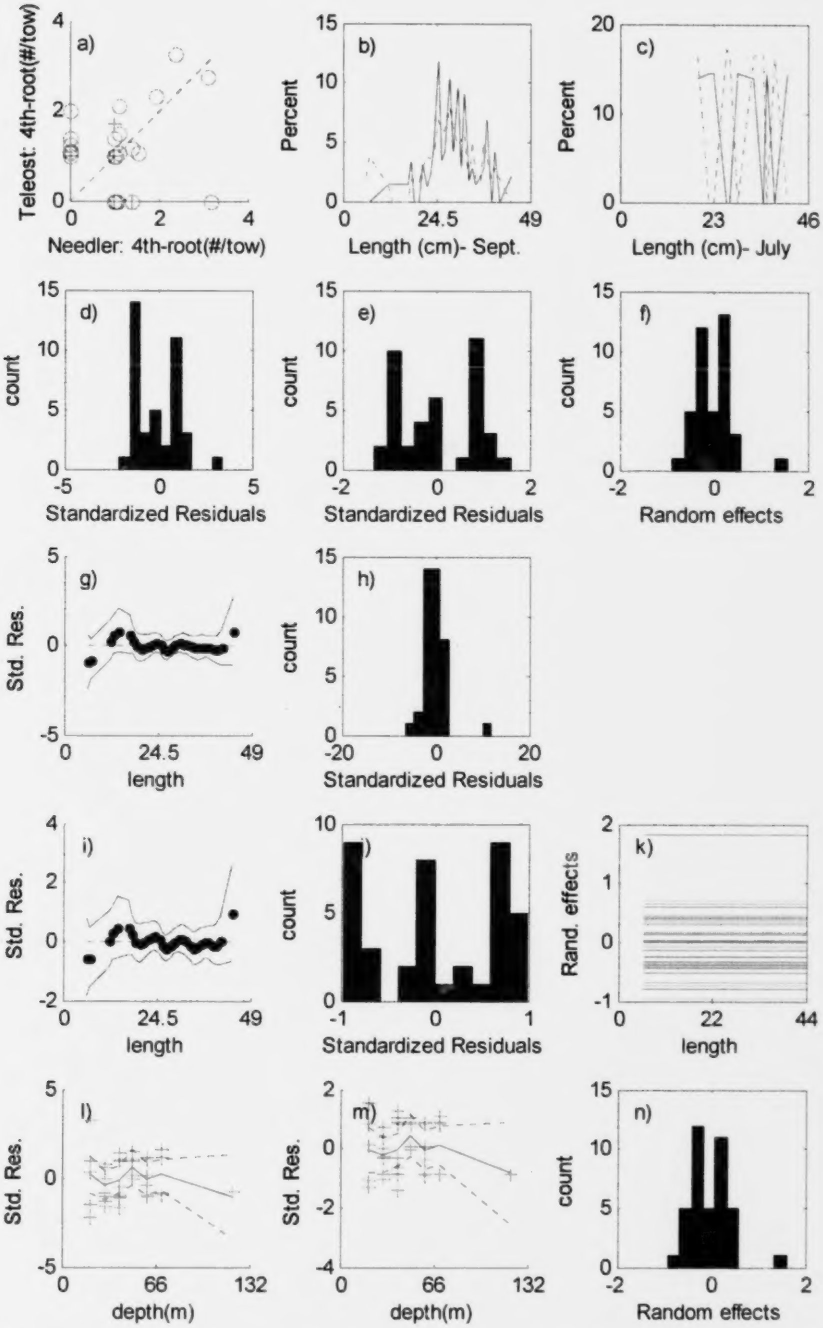

Figure 24. Comparative fishing analysis results for shorthorn sculpin (see Fig. 3 for details on the panel contents).

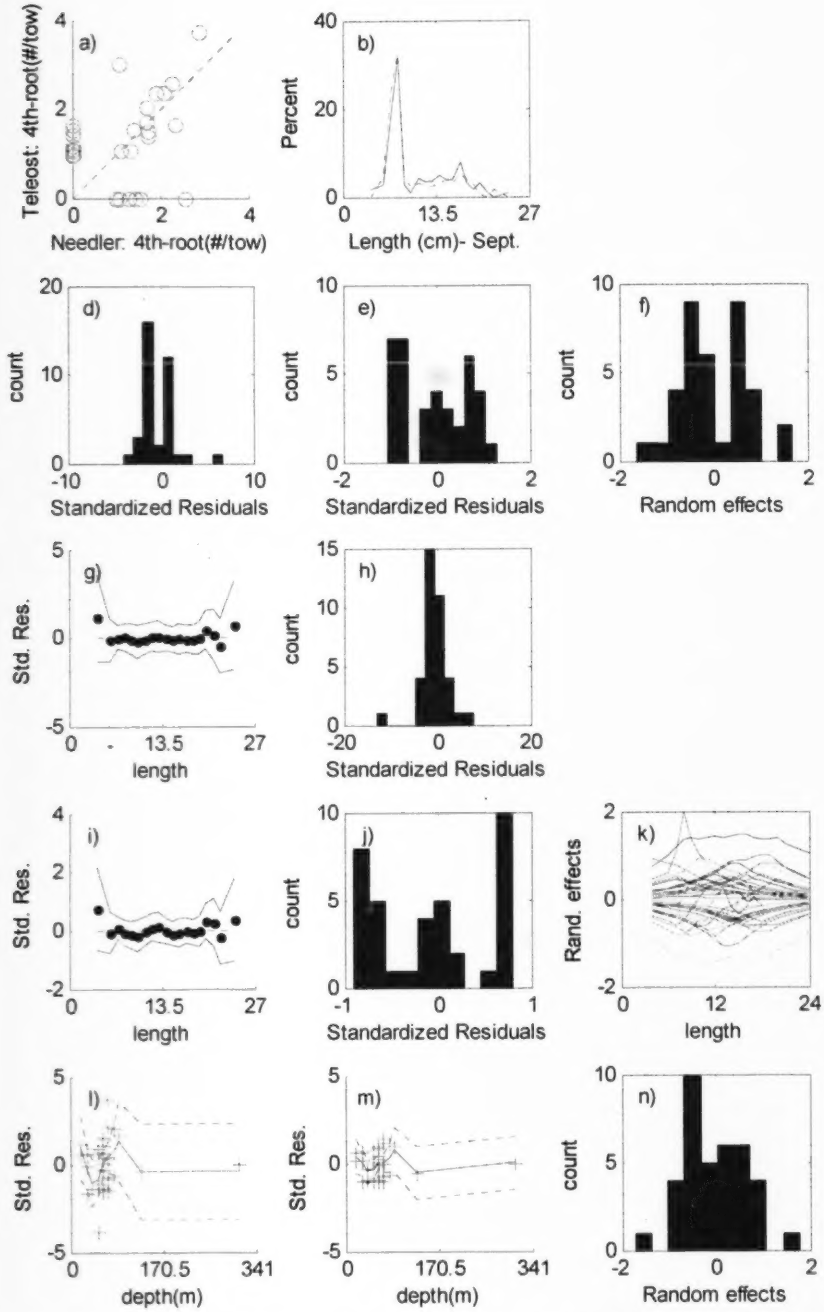

Figure 25. Comparative fishing analysis results for arctic staghorn sculpin (see Fig. 3 for details on the panel contents).

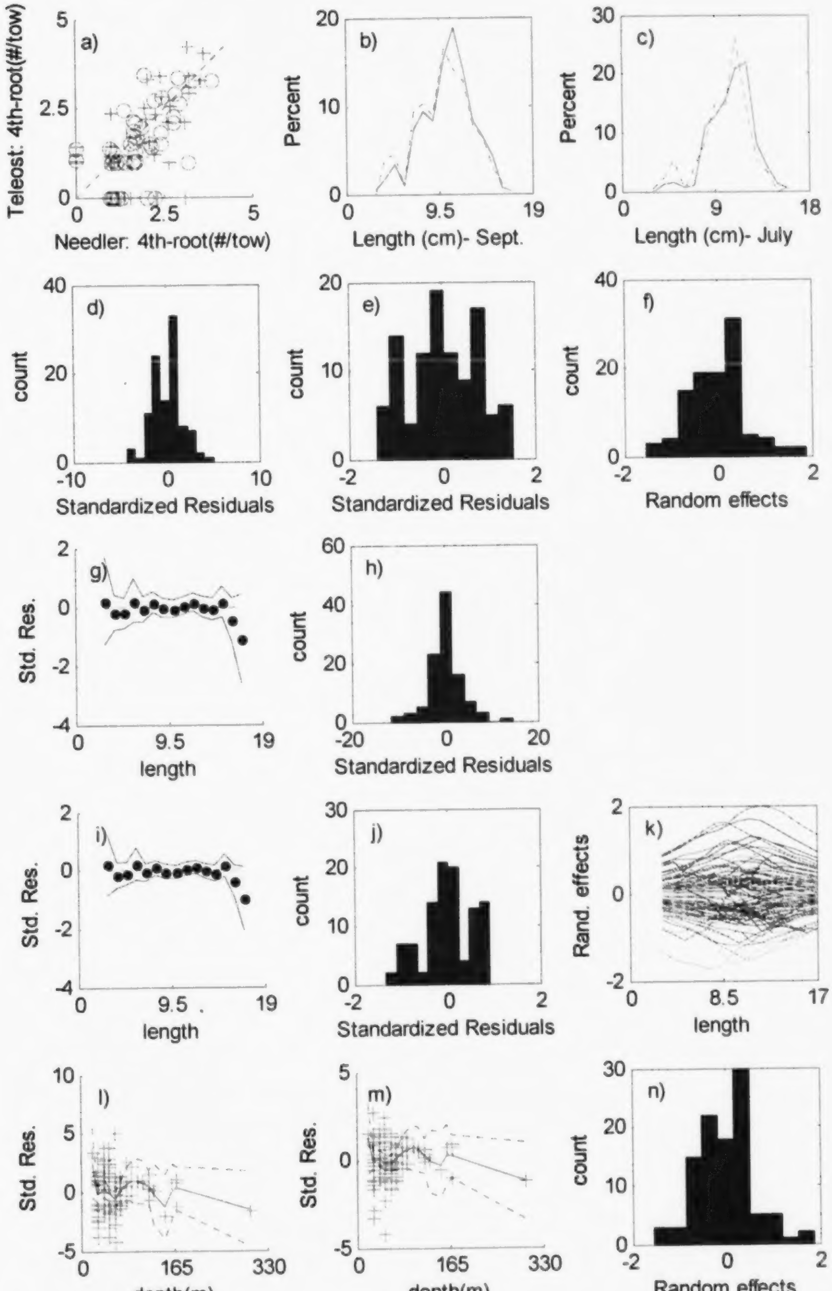

Figure 26. Comparative fishing analysis results for mailed sculpin (see Fig. 3 for details on the panel contents).

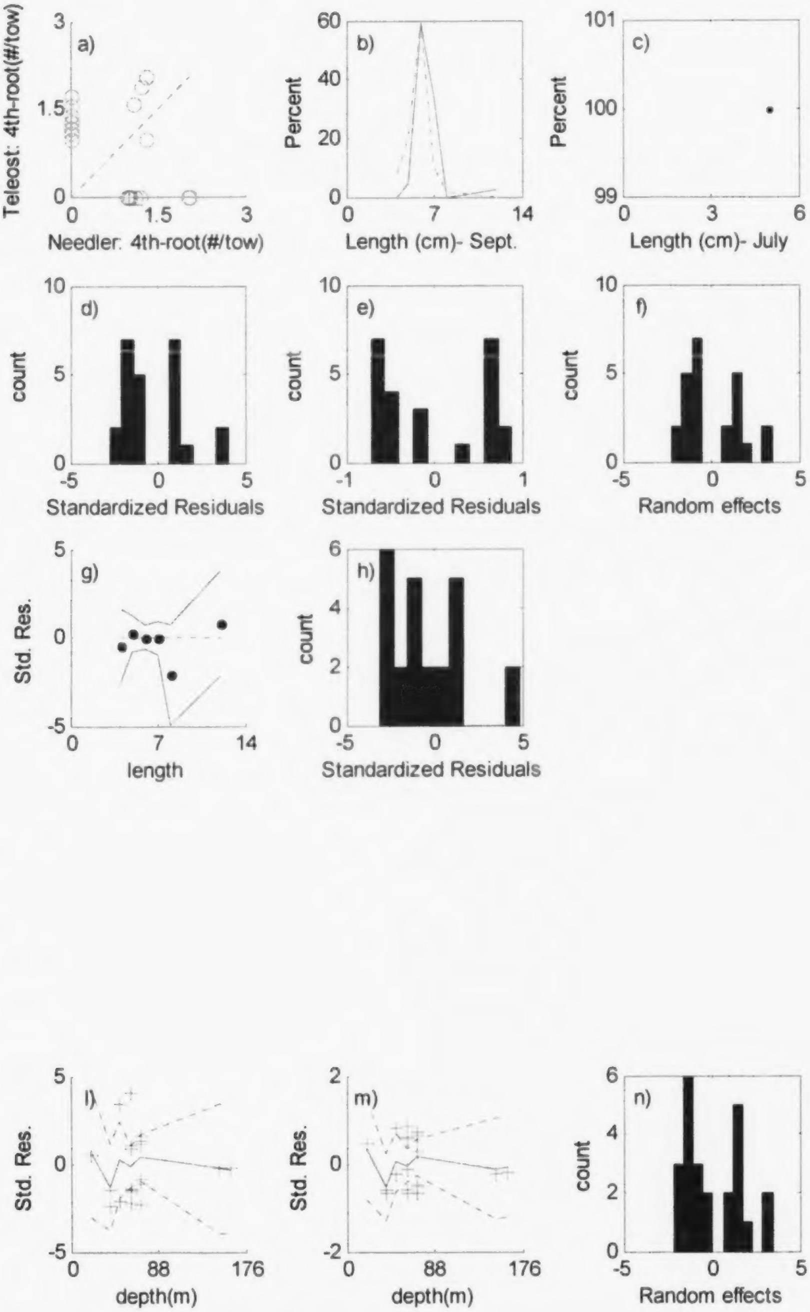

Figure 27. Comparative fishing analysis results for Arctic hookear sculpin (see Fig. 3 for details on the panel contents).

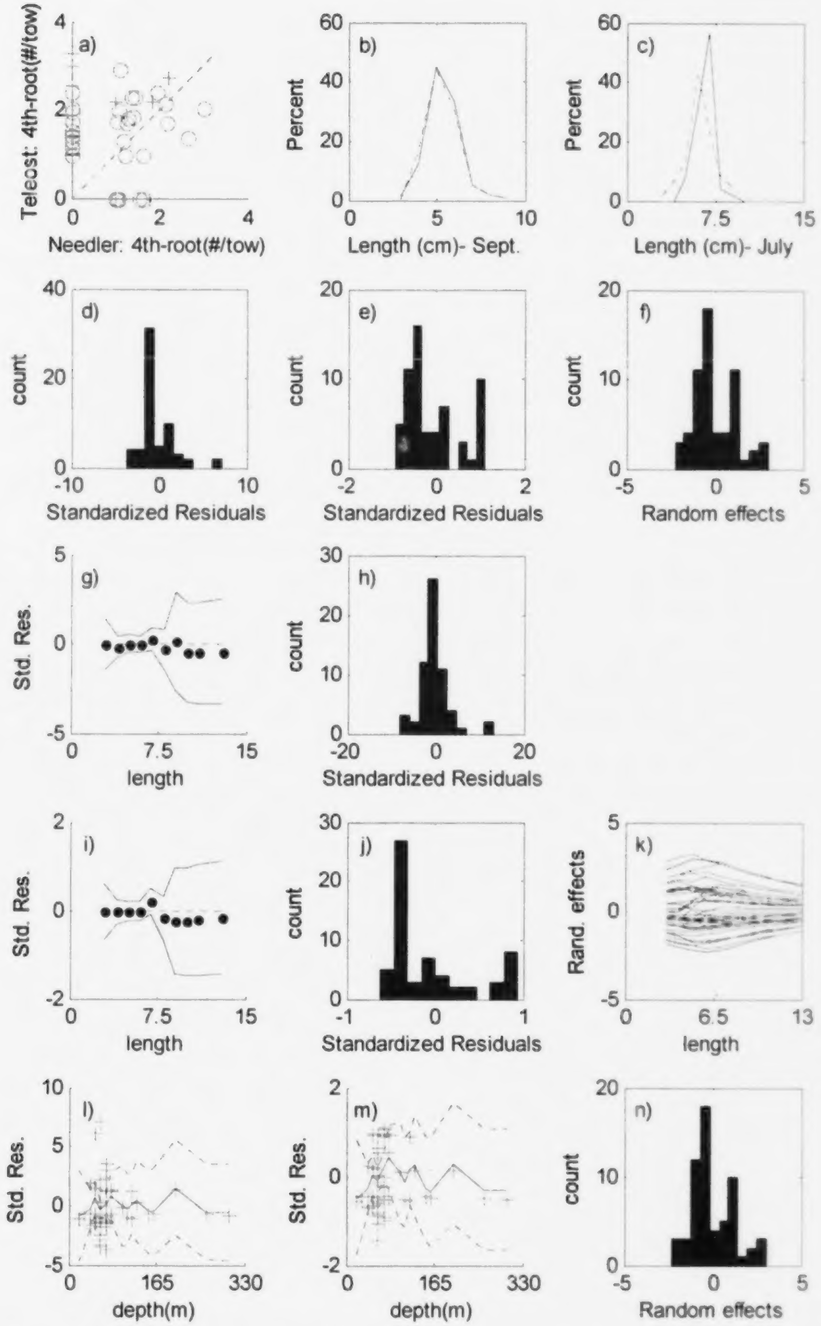

Figure 28. Comparative fishing analysis results for Atlantic hookear sculpin (see Fig. 3 for details on the panel contents).

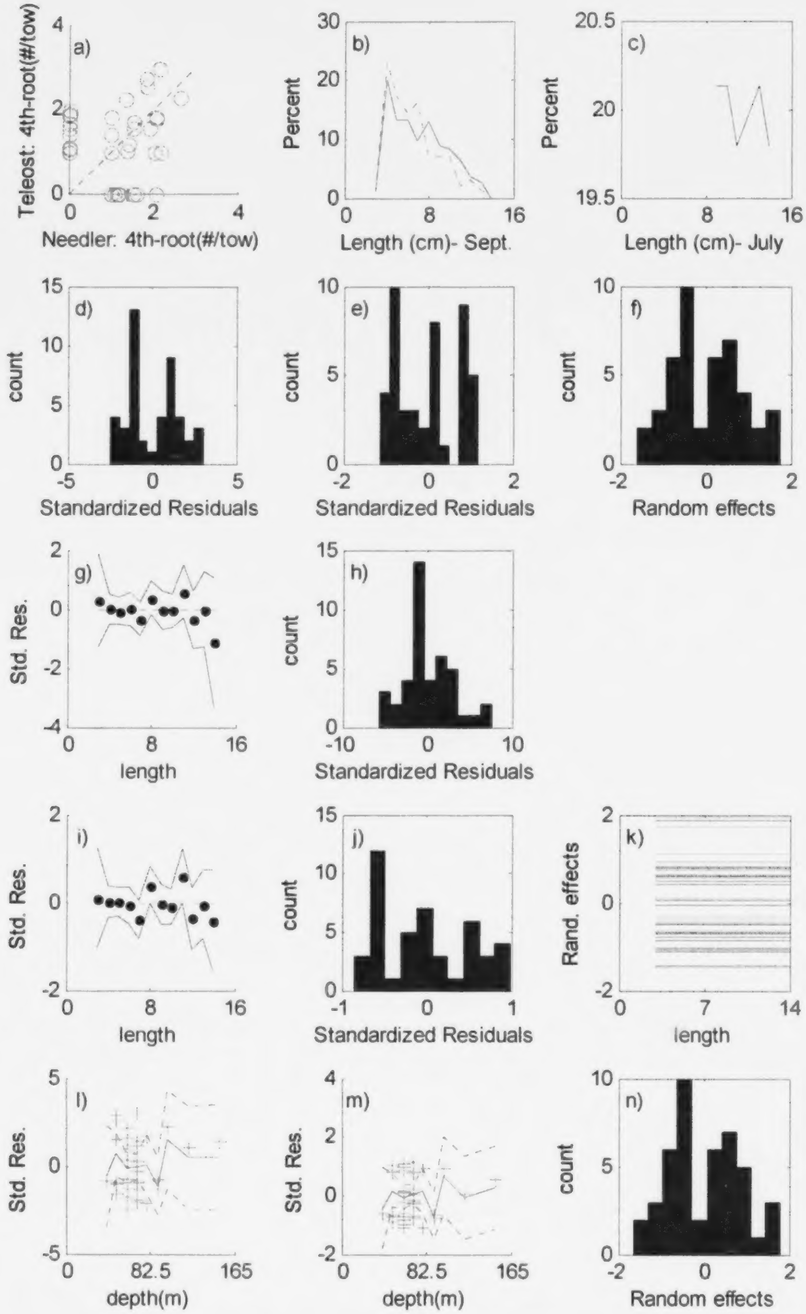

Figure 29. Comparative fishing analysis results for spatulate sculpin (see Fig. 3 for details on the panel contents).

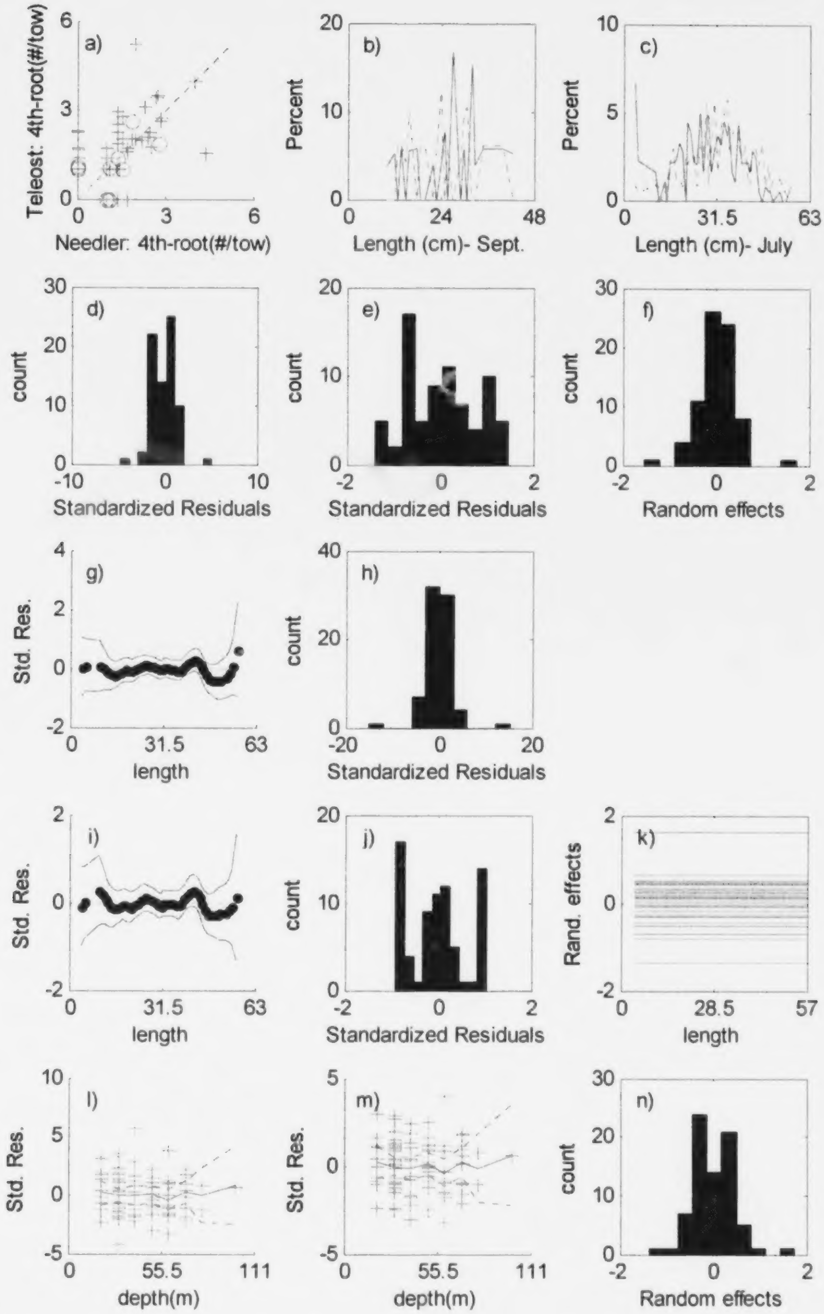

Figure 30. Comparative fishing analysis results for sea raven (see Fig. 3 for details on the panel contents).

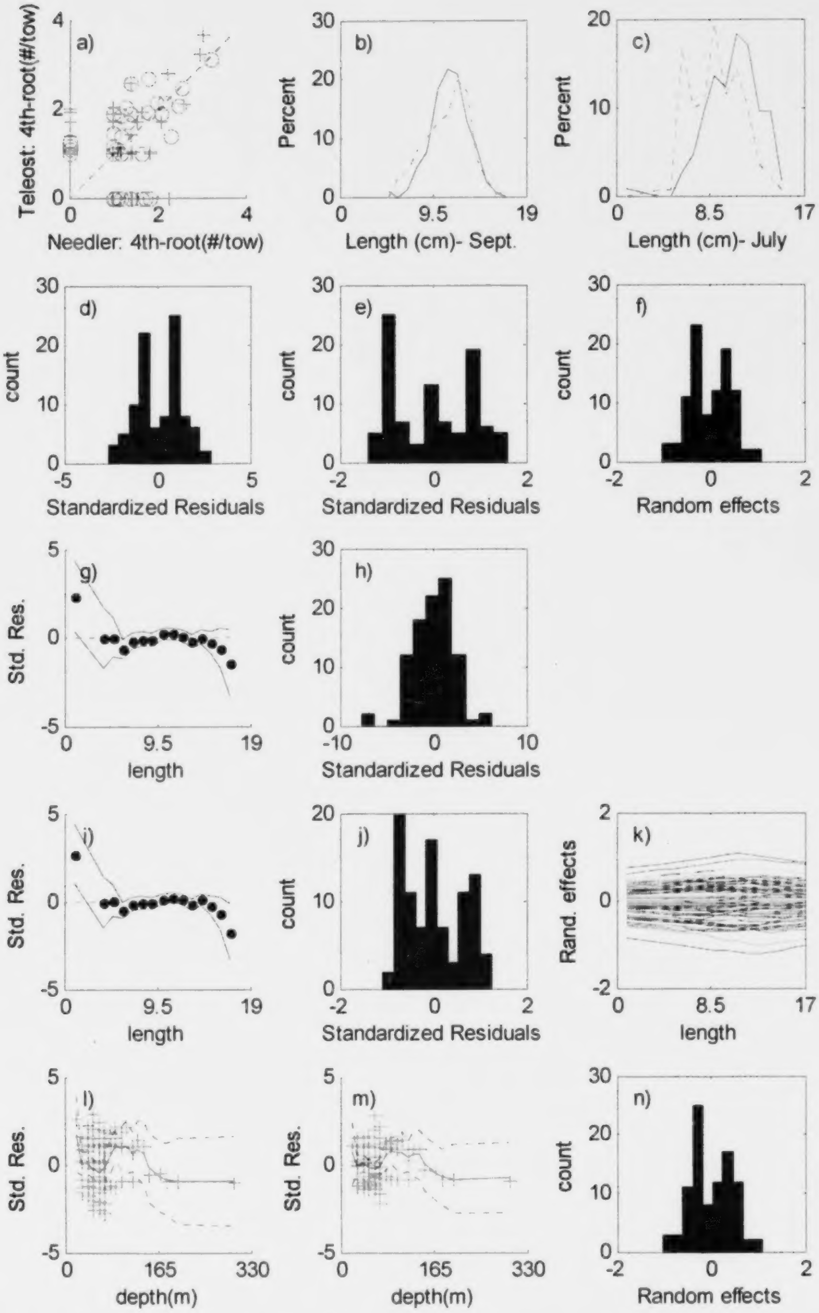

Figure 31. Comparative fishing analysis results for alligatorfish (see Fig. 3 for details on the panel contents).

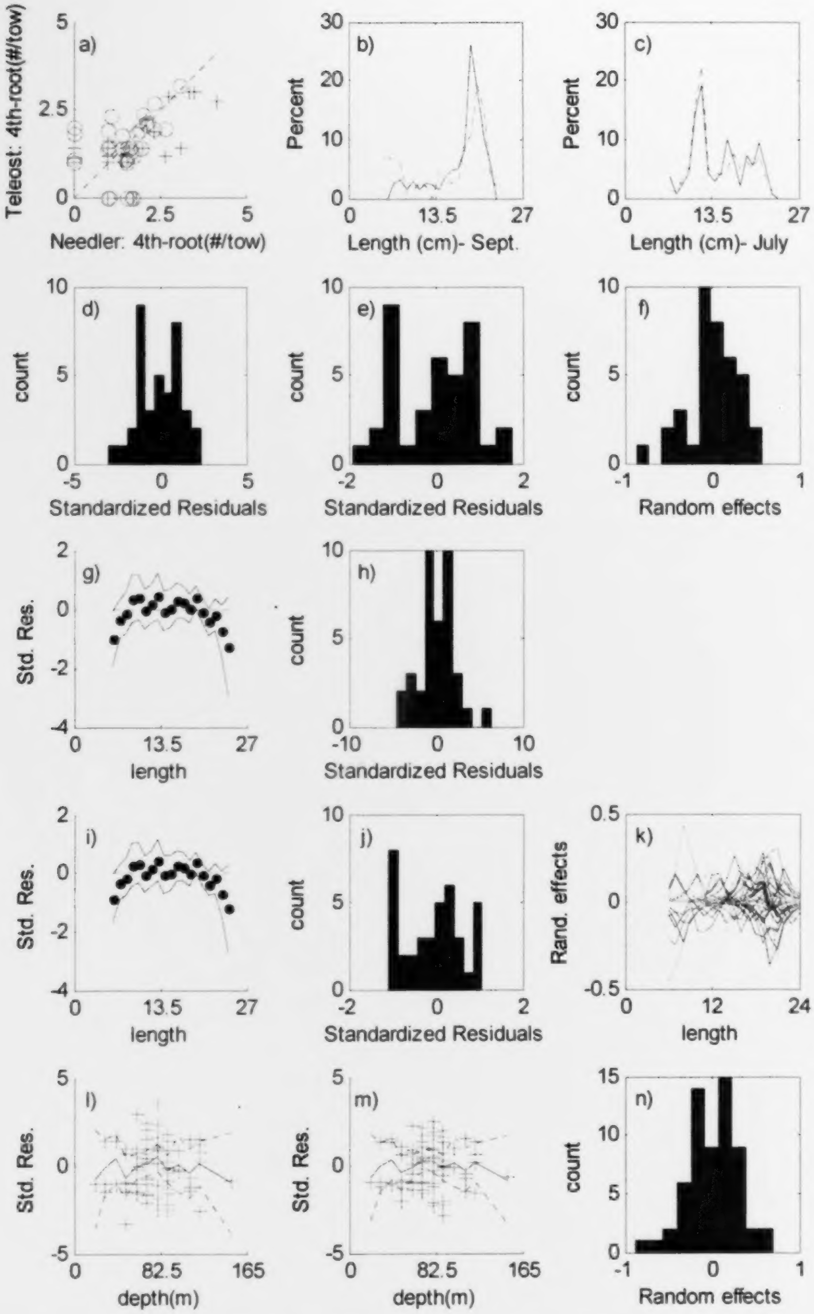

Figure 32. Comparative fishing analysis results for sea poacher (see Fig. 3 for details on the panel contents).

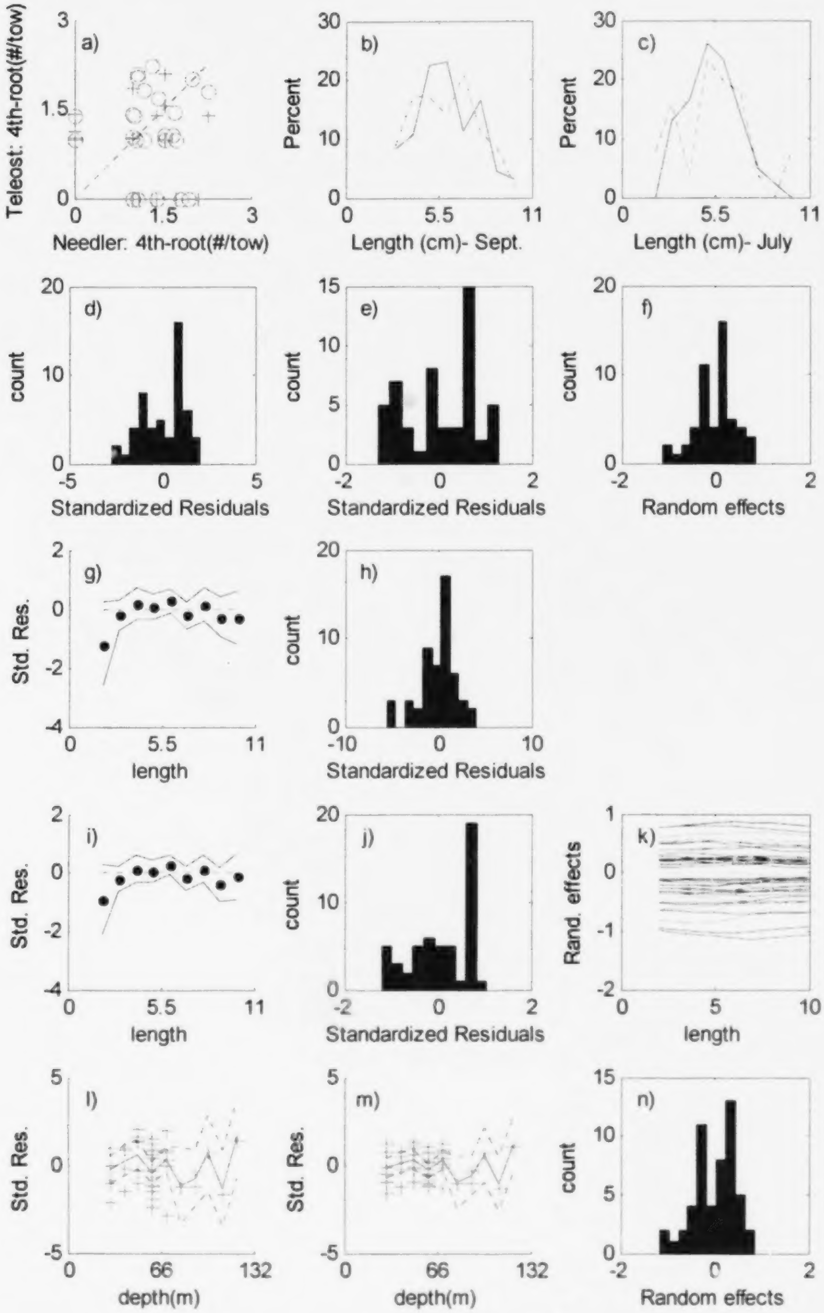

Figure 33. Comparative fishing analysis results for spiny lumpsucker (see Fig. 3 for details on the panel contents).

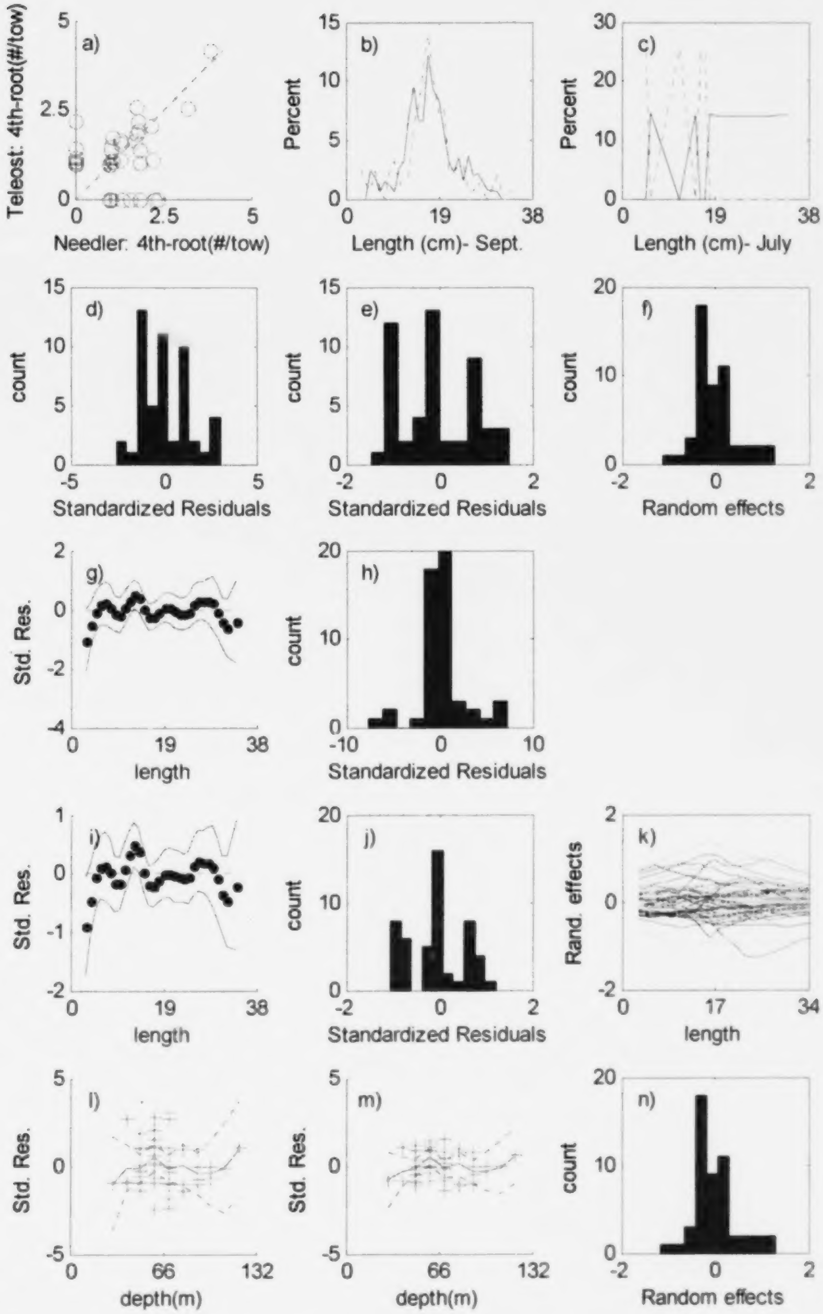

Figure 34. Comparative fishing analysis results for dusky seasnail (see Fig. 3 for details on the panel contents).

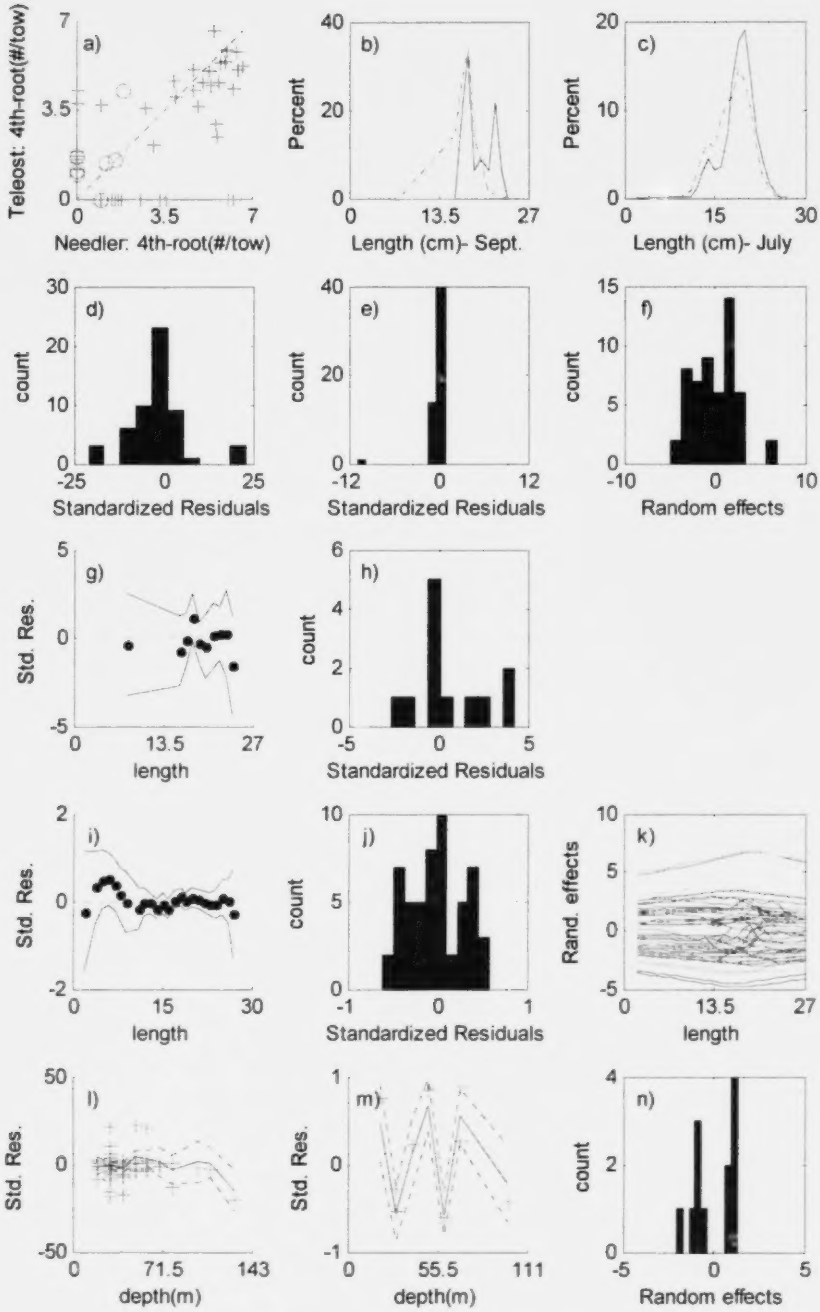

Figure 35. Comparative fishing analysis results for sandlance (see Fig. 3 for details on the panel contents).

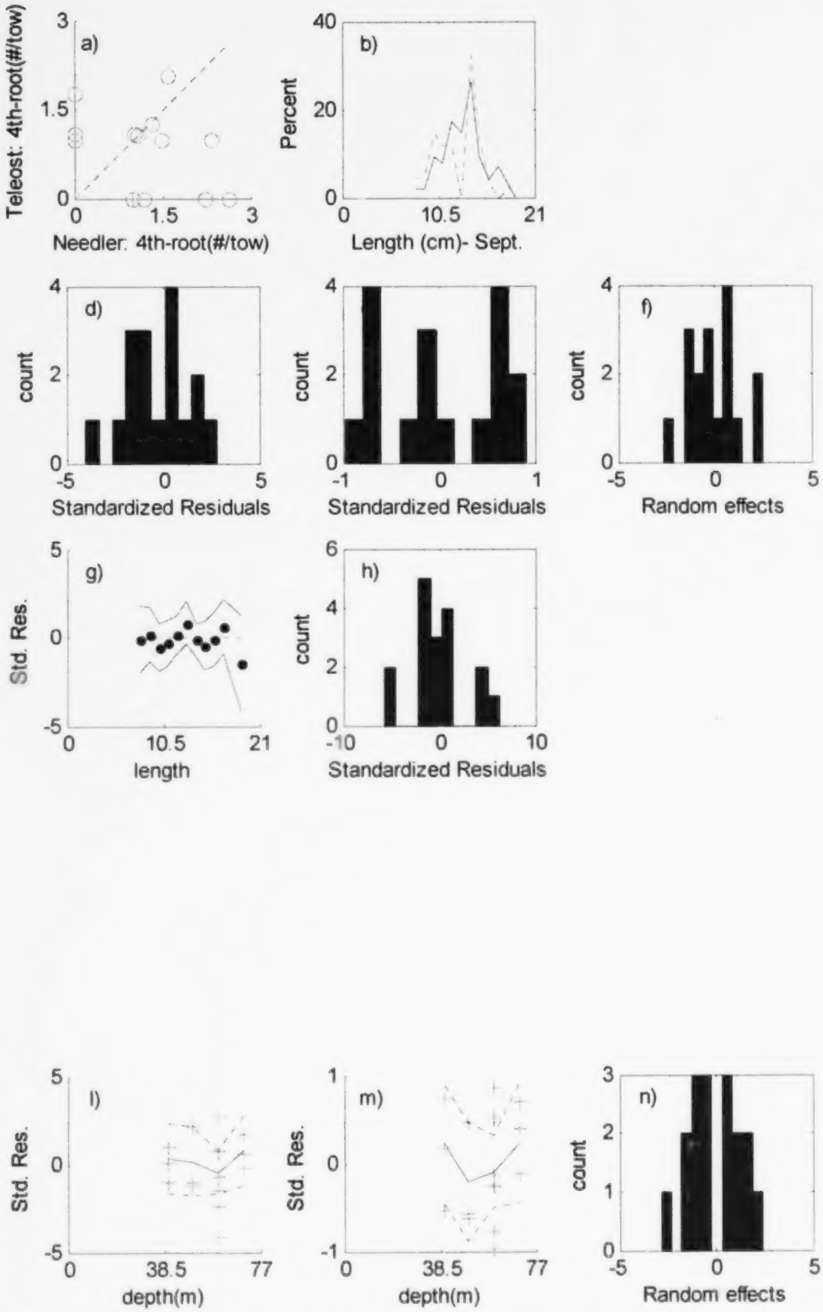

Figure 36. Comparative fishing analysis results for fish doctor (see Fig. 3 for details on the panel contents).

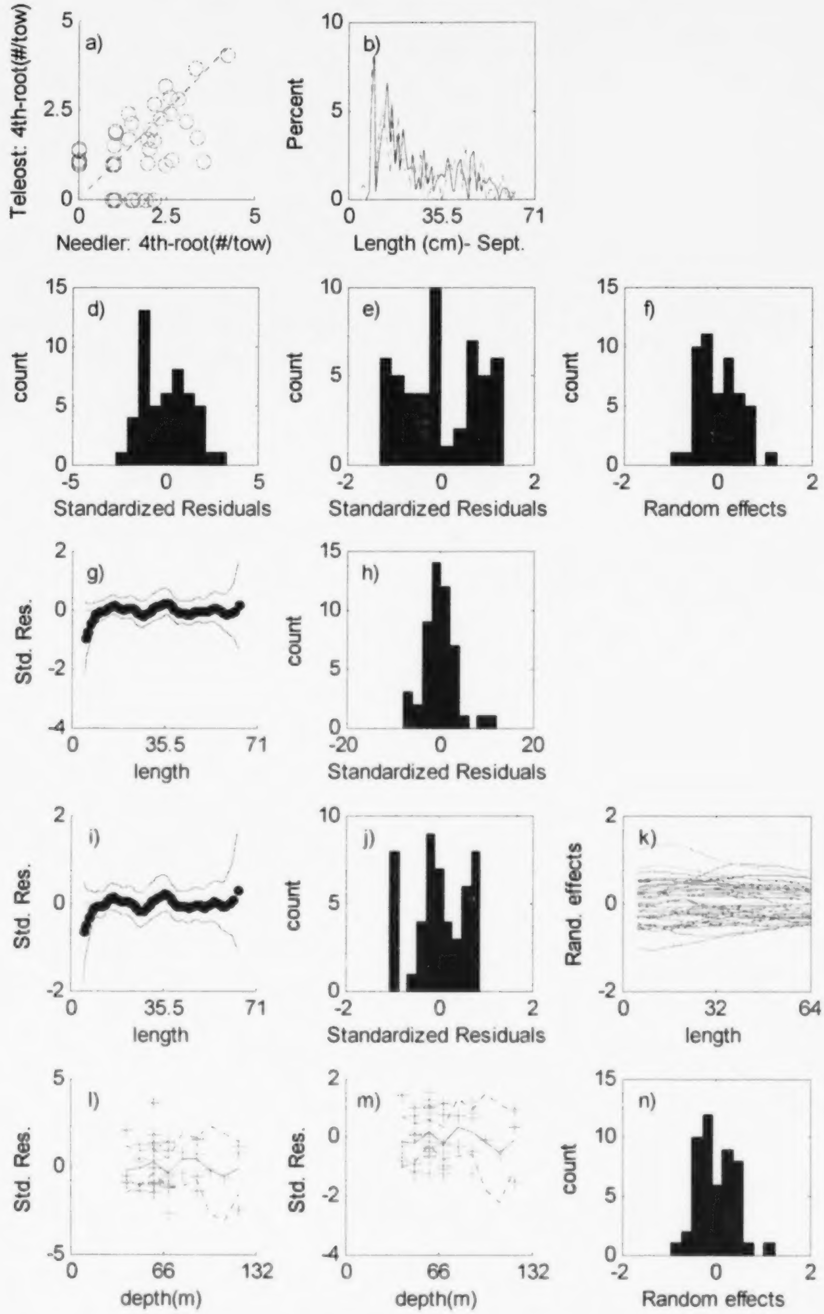

Figure 37. Comparative fishing analysis results for Laval's eelpout (see Fig. 3 for details on the panel contents).

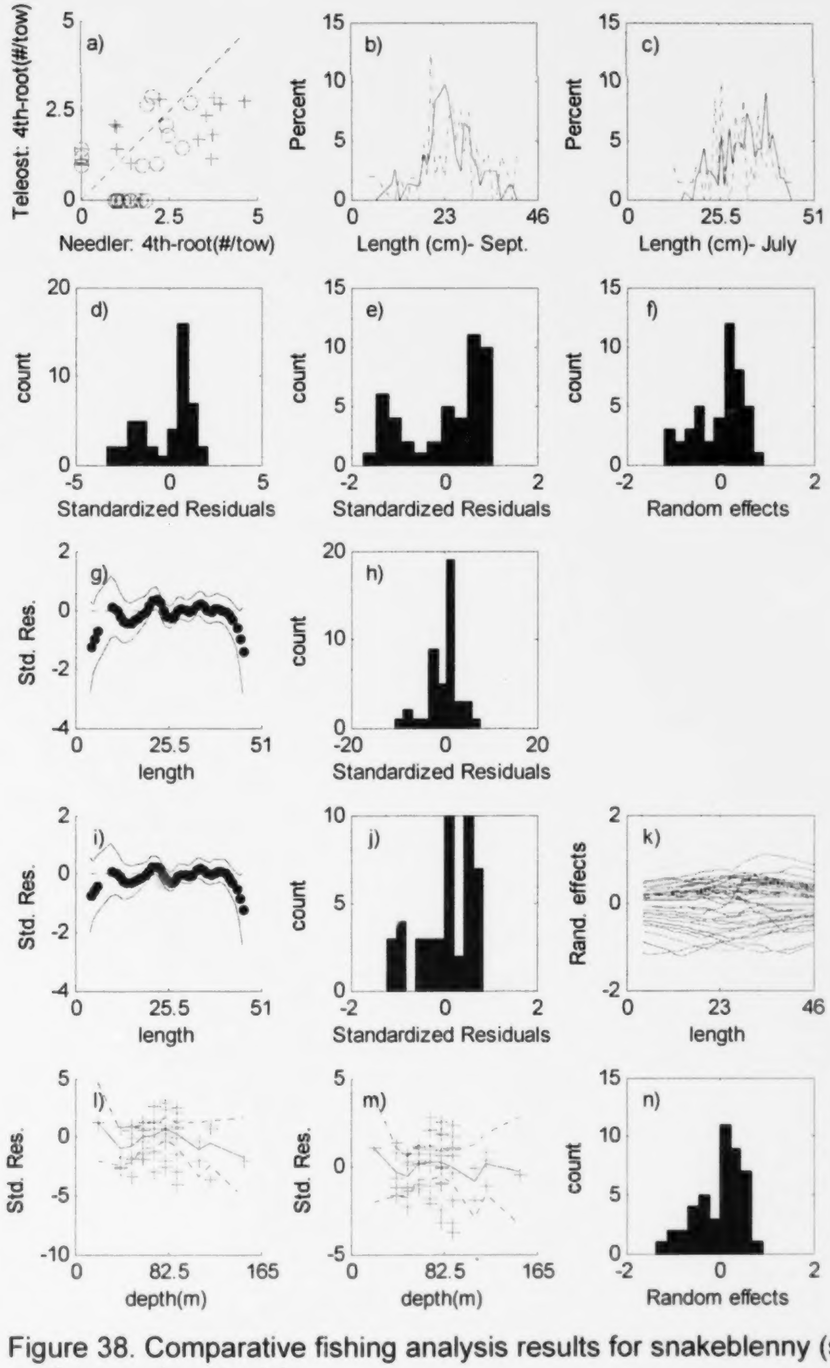

Figure 38. Comparative fishing analysis results for snakeblenny (see Fig. 3 for details on the panel contents).

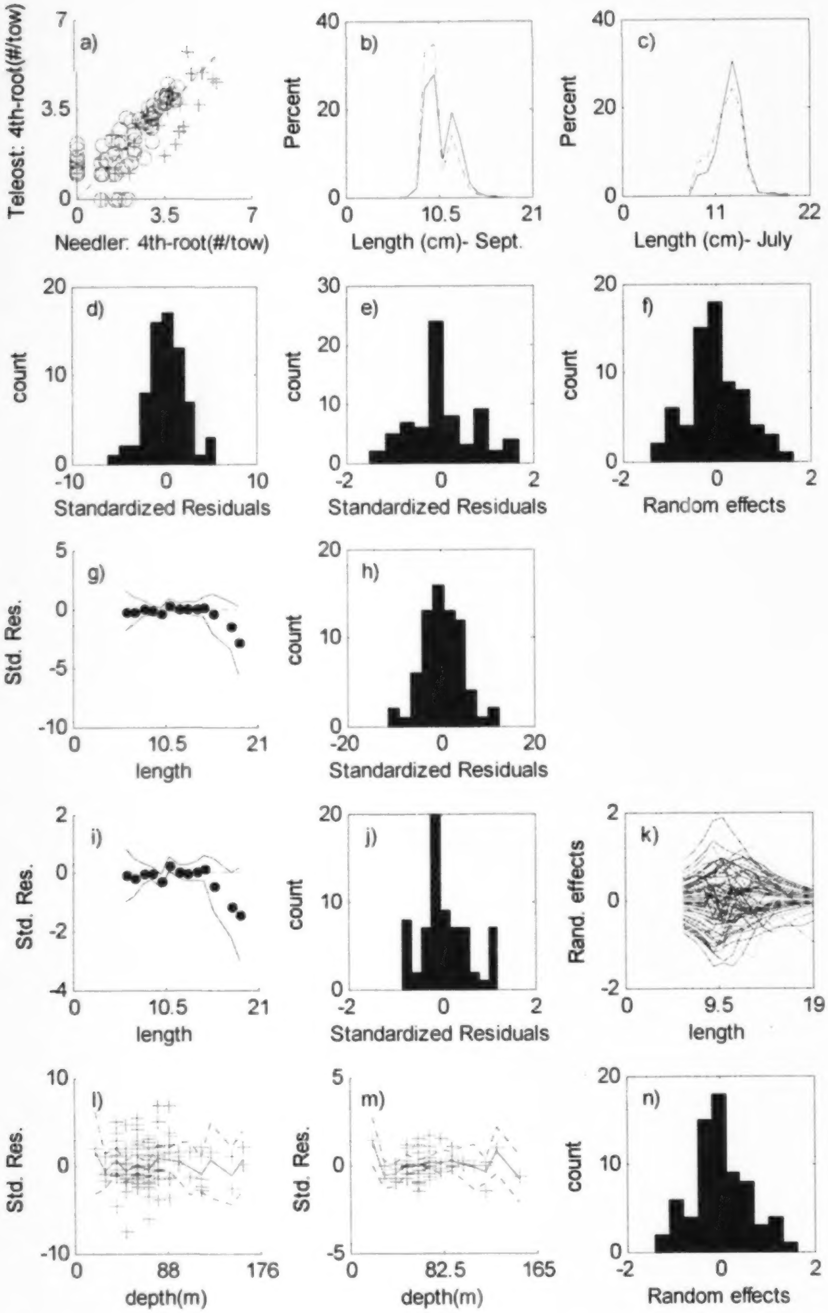

Figure 39. Comparative fishing analysis results for daubed shanny (see Fig. 3 for details on the panel contents).

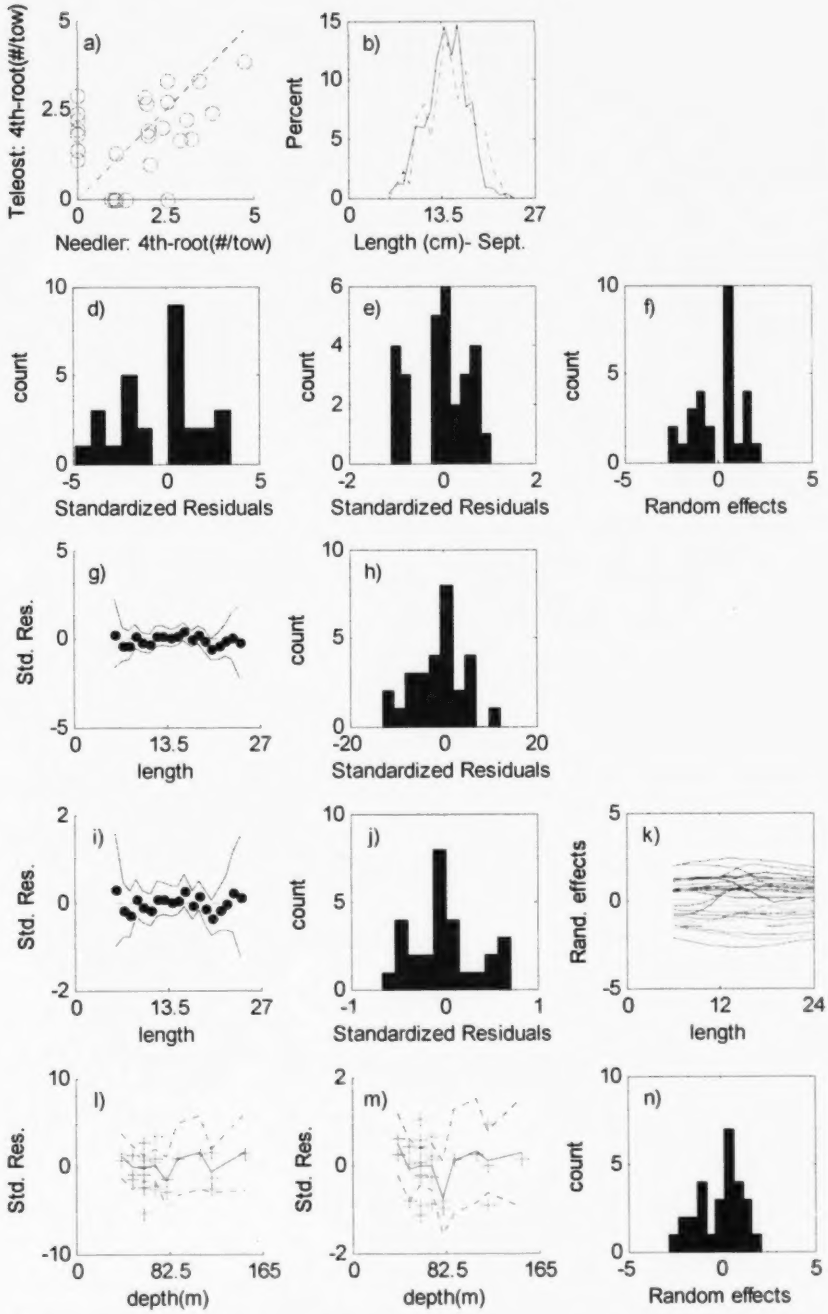

Figure 40. Comparative fishing analysis results for fourline snakeblenny (see Fig. 3 for details on the panel contents).

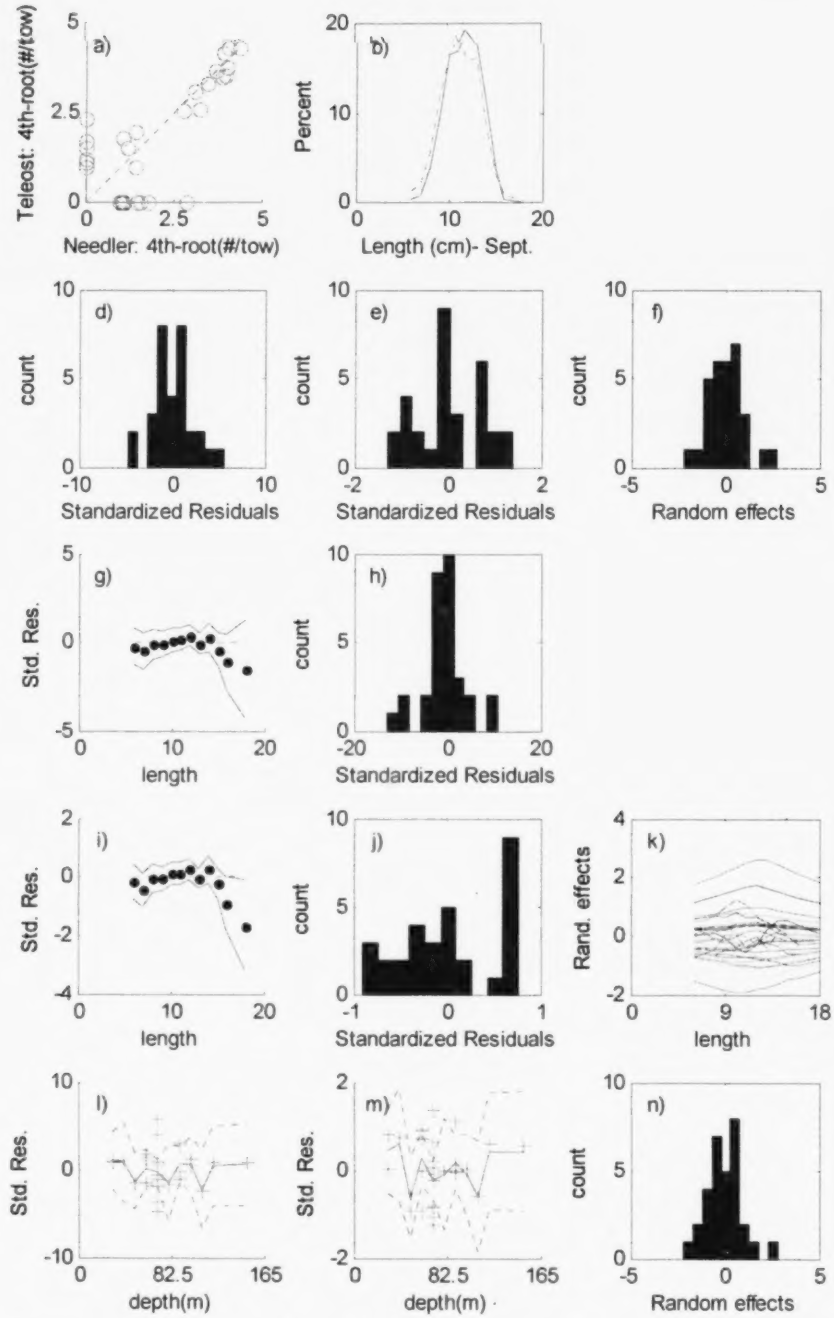

Figure 41. Comparative fishing analysis results for stout eelblenny (see Fig. 3 for details on the panel contents).

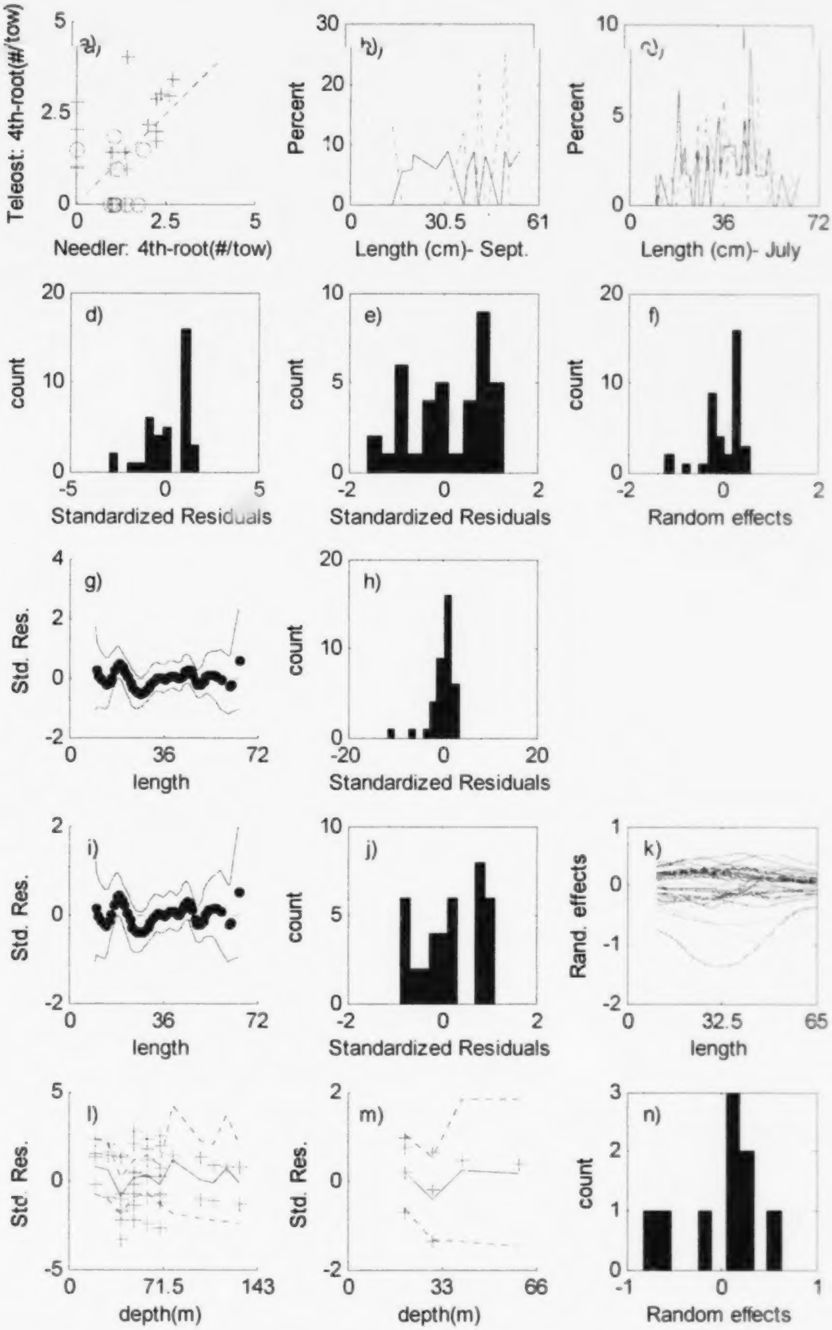

Figure 42. Comparative fishing analysis results for ocean pout (see Fig. 3 for details on the panel contents).

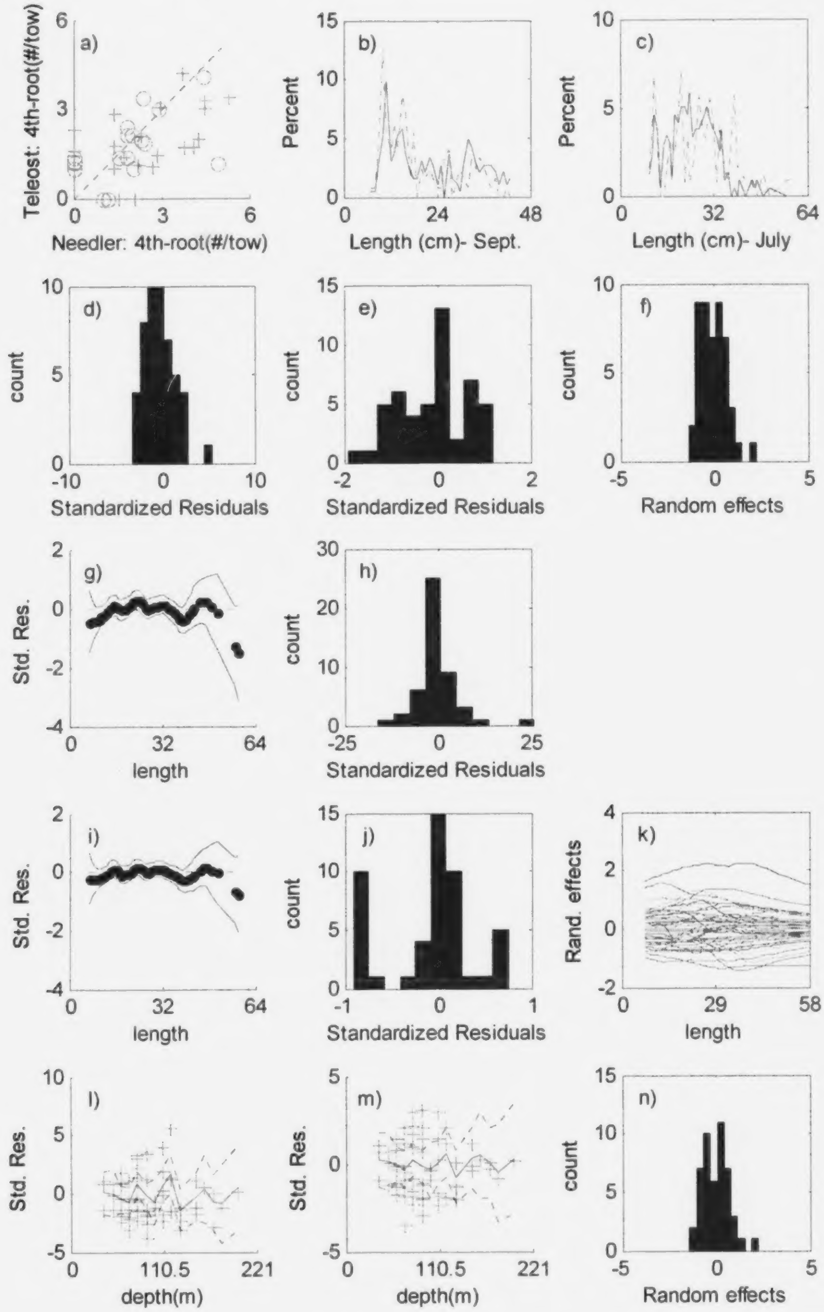

Figure 43. Comparative fishing analysis results for Vahl's eelpout (see Fig. 3 for details on the panel contents).

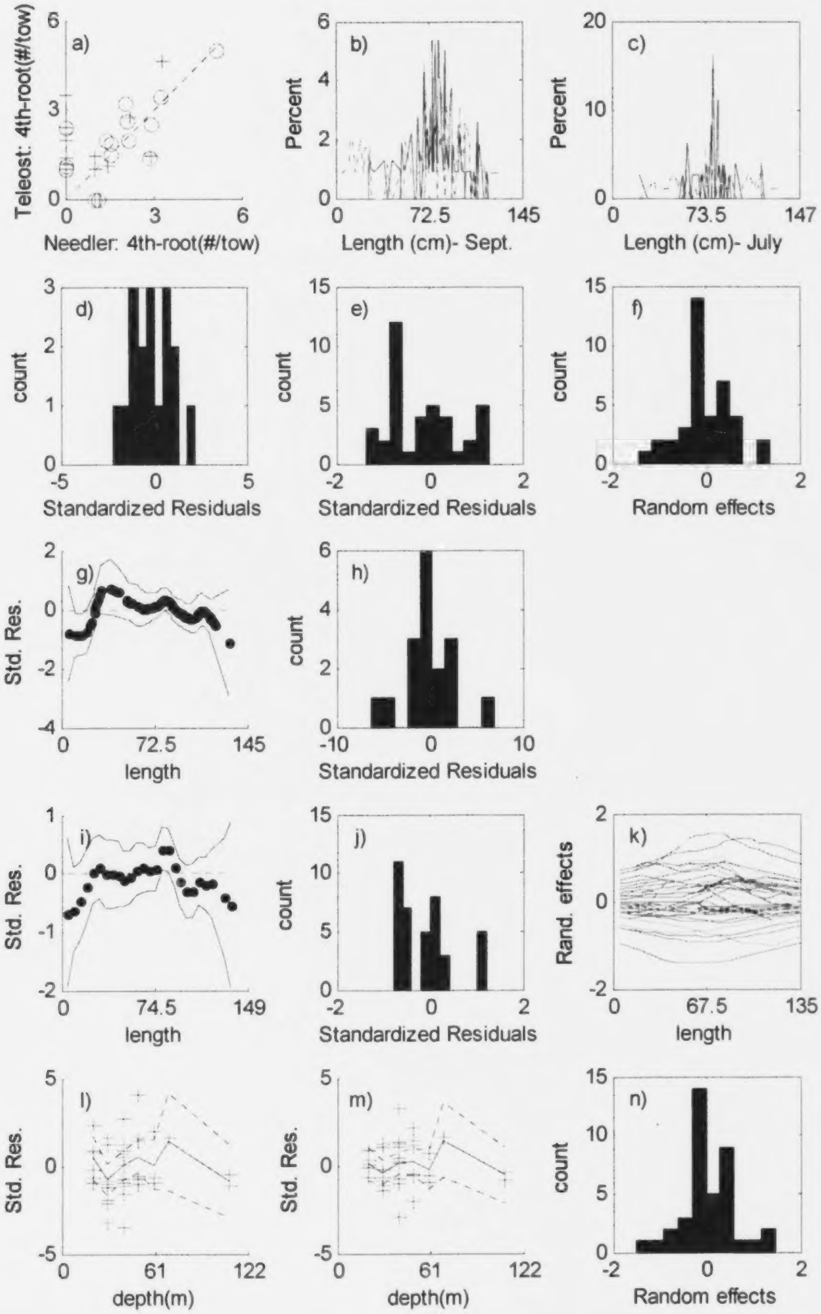

Figure 44. Comparative fishing analysis results for rock crab (see Fig. 3 for details on the panel contents).

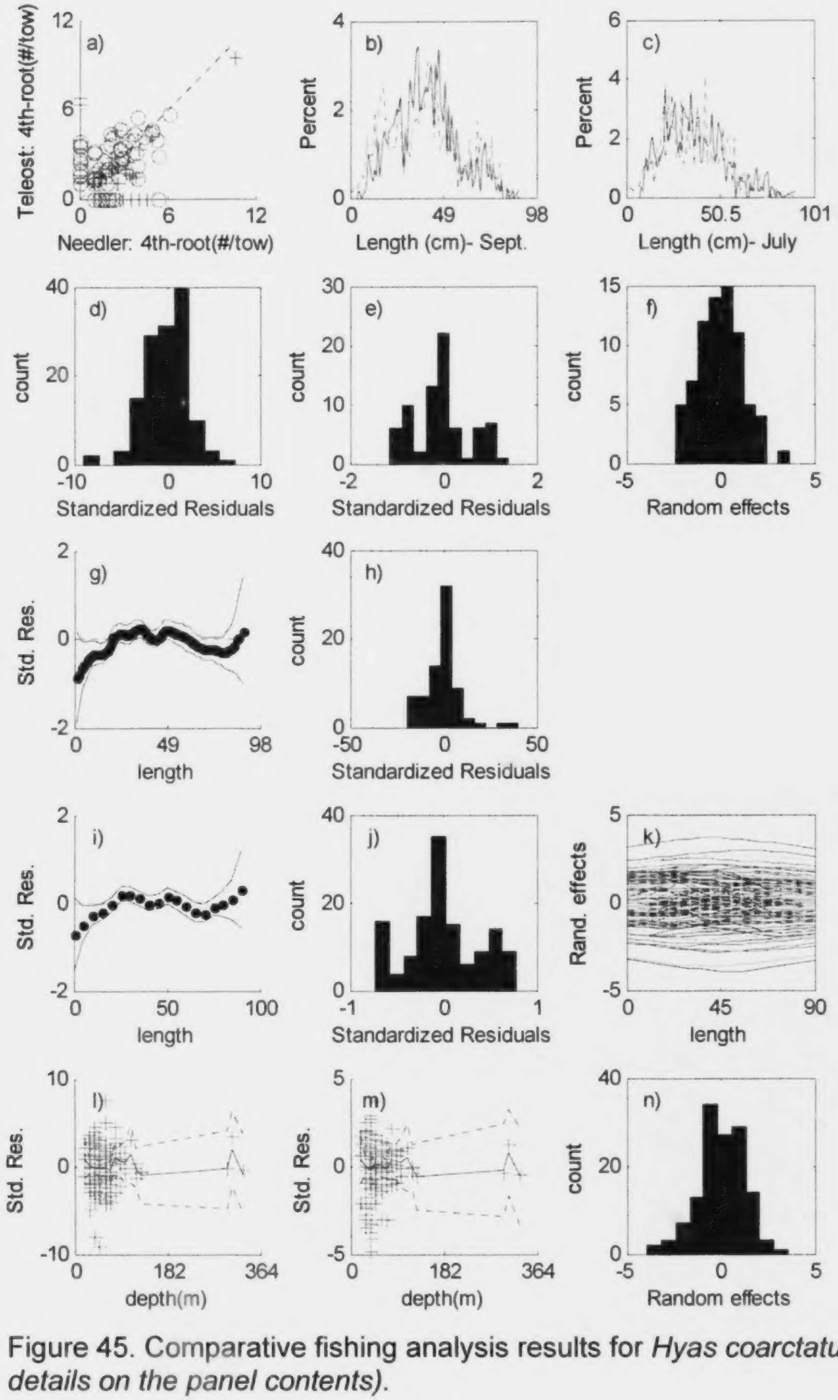

Figure 45. Comparative fishing analysis results for *Hyas coarctatus (see Fig. 3 for details on the panel contents).*

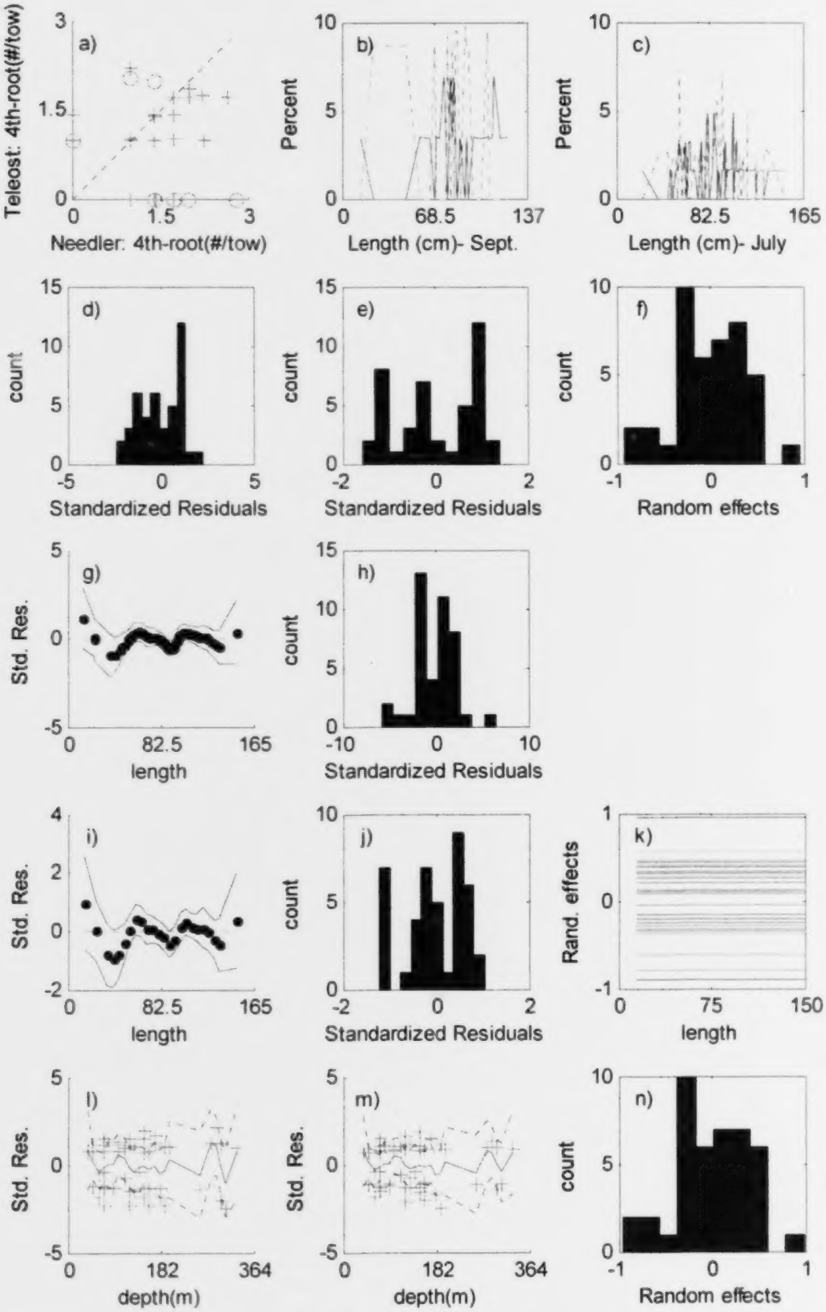

Figure 46. Comparative fishing analysis results for northern stone crab *(see Fig. 3 for details on the panel contents).*

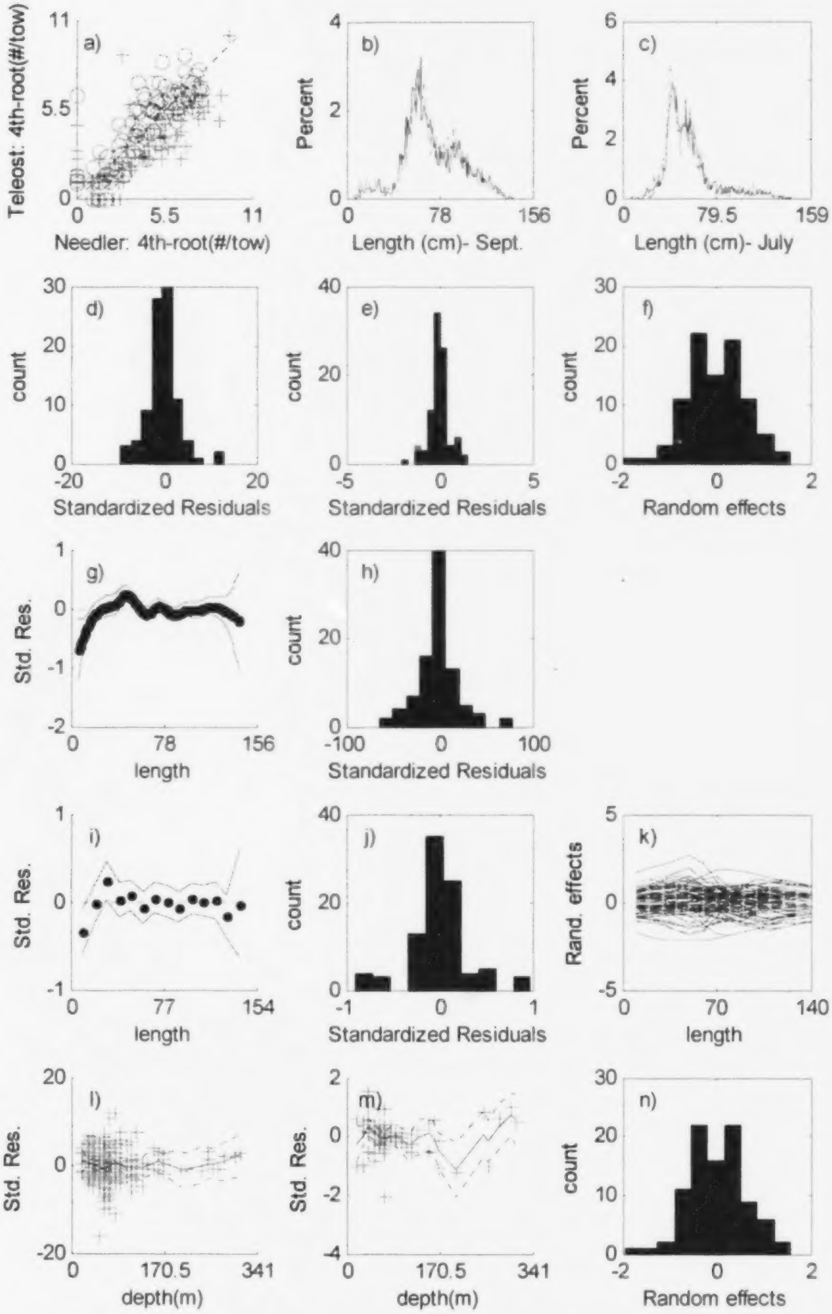

Figure 47. Comparative fishing analysis results for snow crab *(see Fig. 3 for details on the panel contents).*

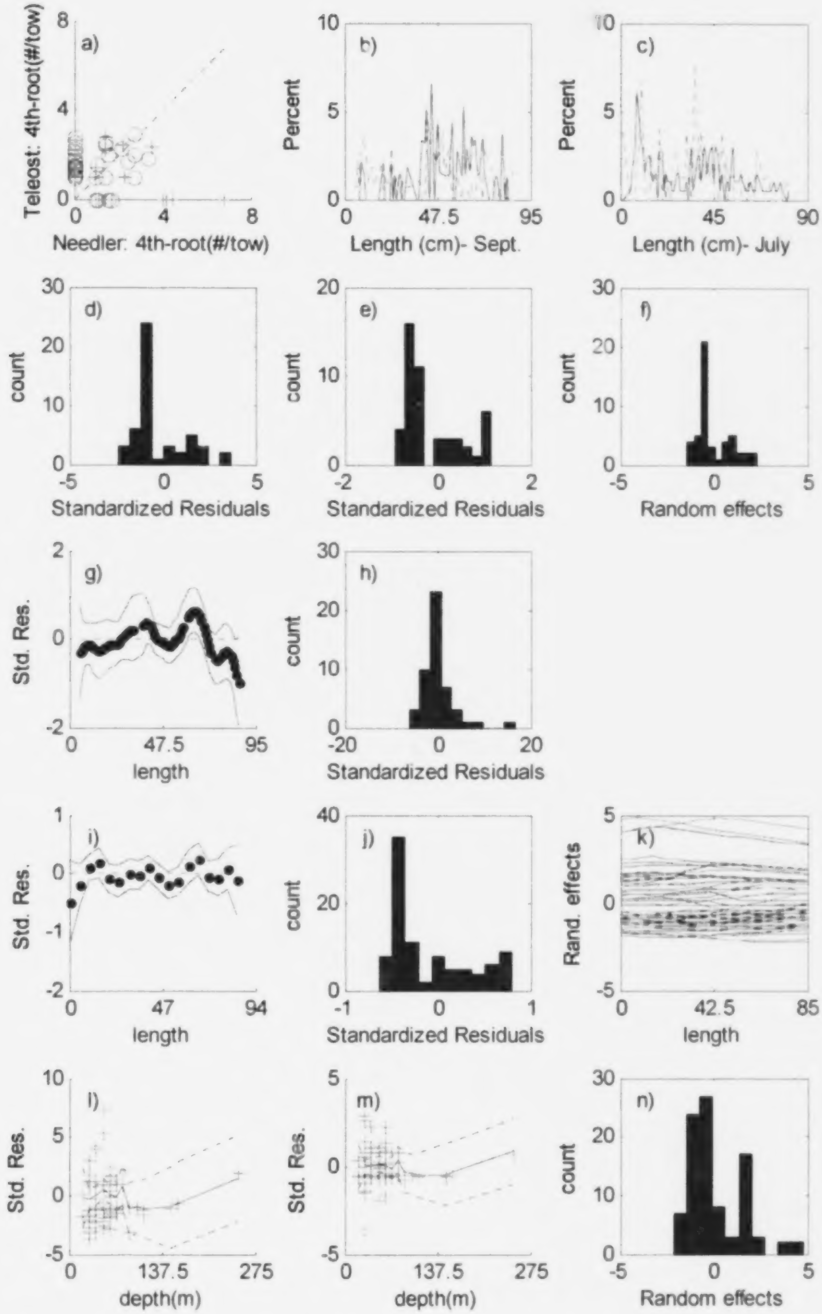

Figure 48. Comparative fishing analysis results for *Hyas araneus (see Fig. 3 for details on the panel contents).*

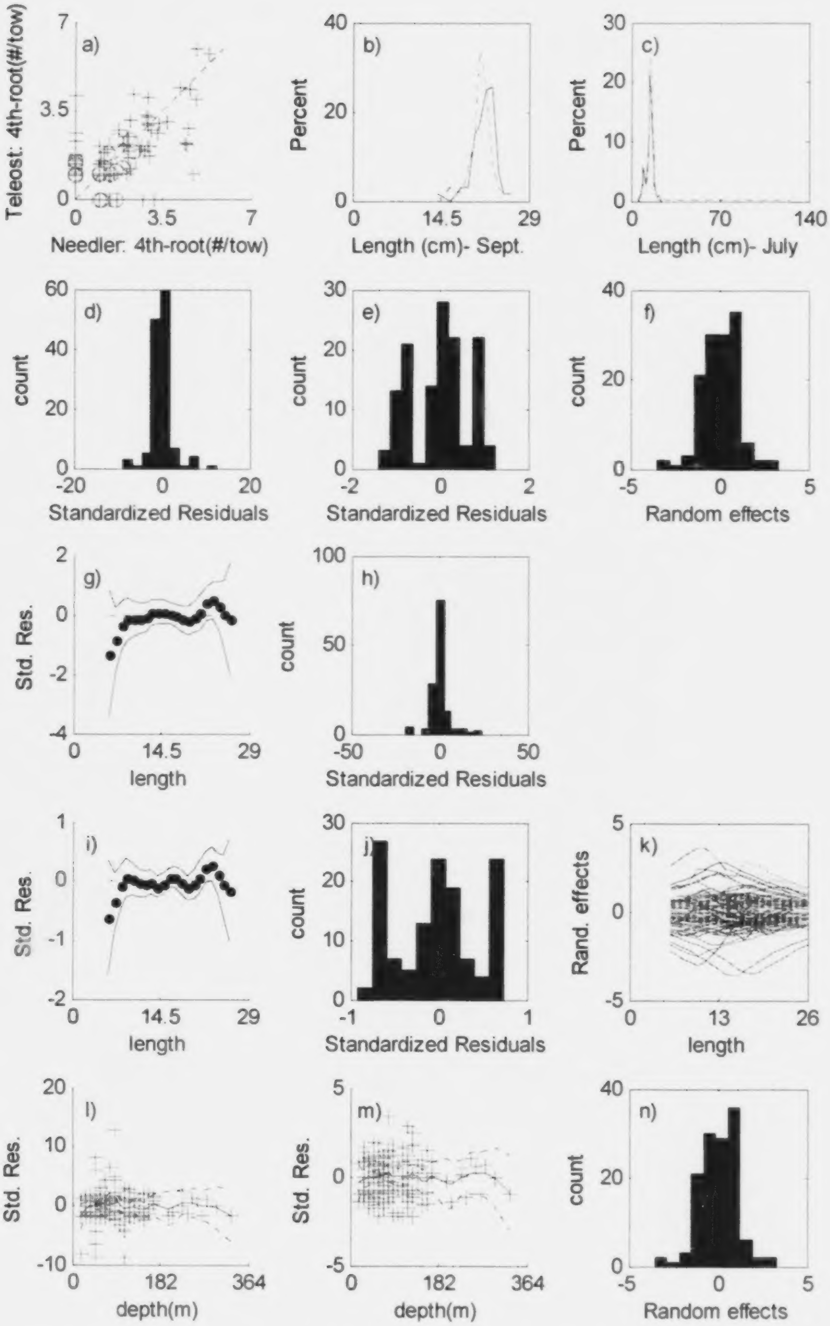

Figure 49. Comparative fishing analysis results for shortfin squid *(see Fig. 3 for details on the panel contents).*

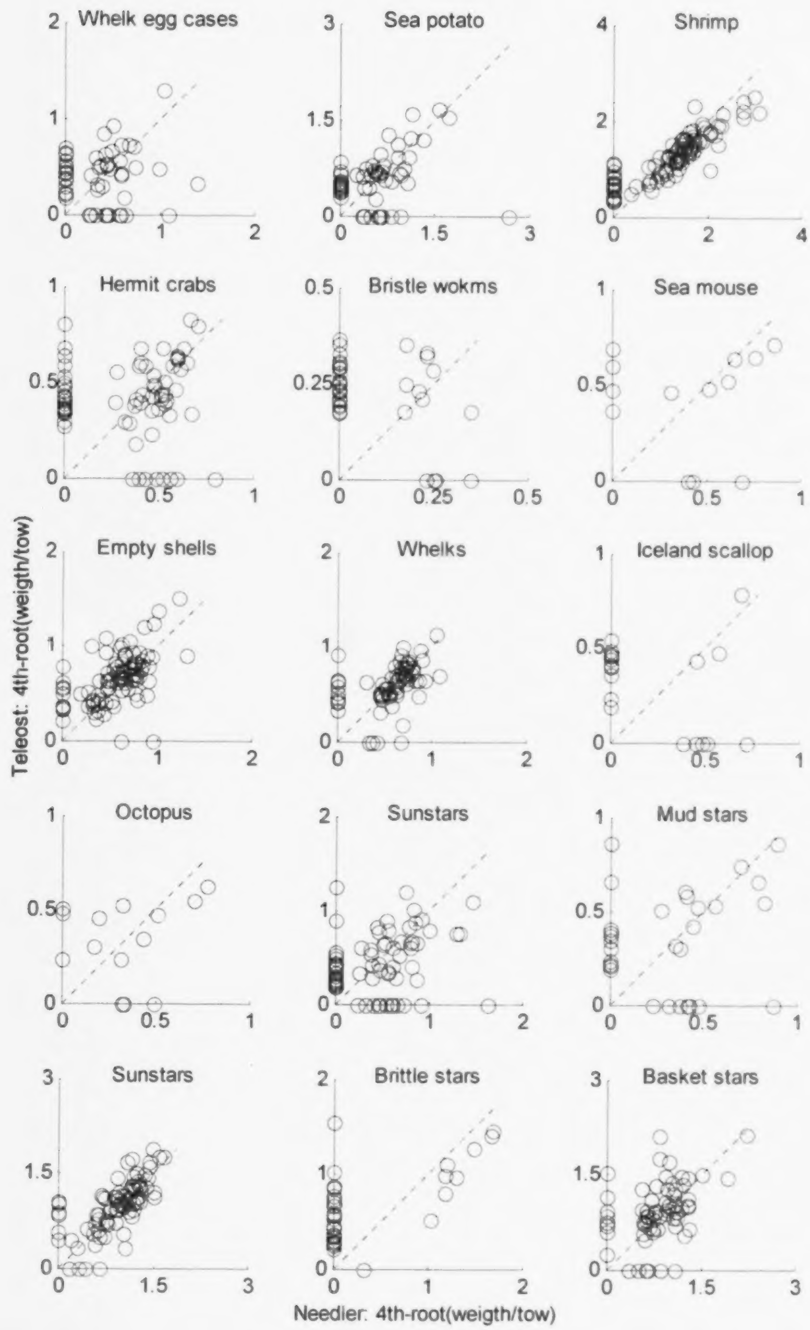

Figure 50. Total standardized catches of various invertebrate species from paired sets by the Teleost vs. Alfred Needler from the September experiments.

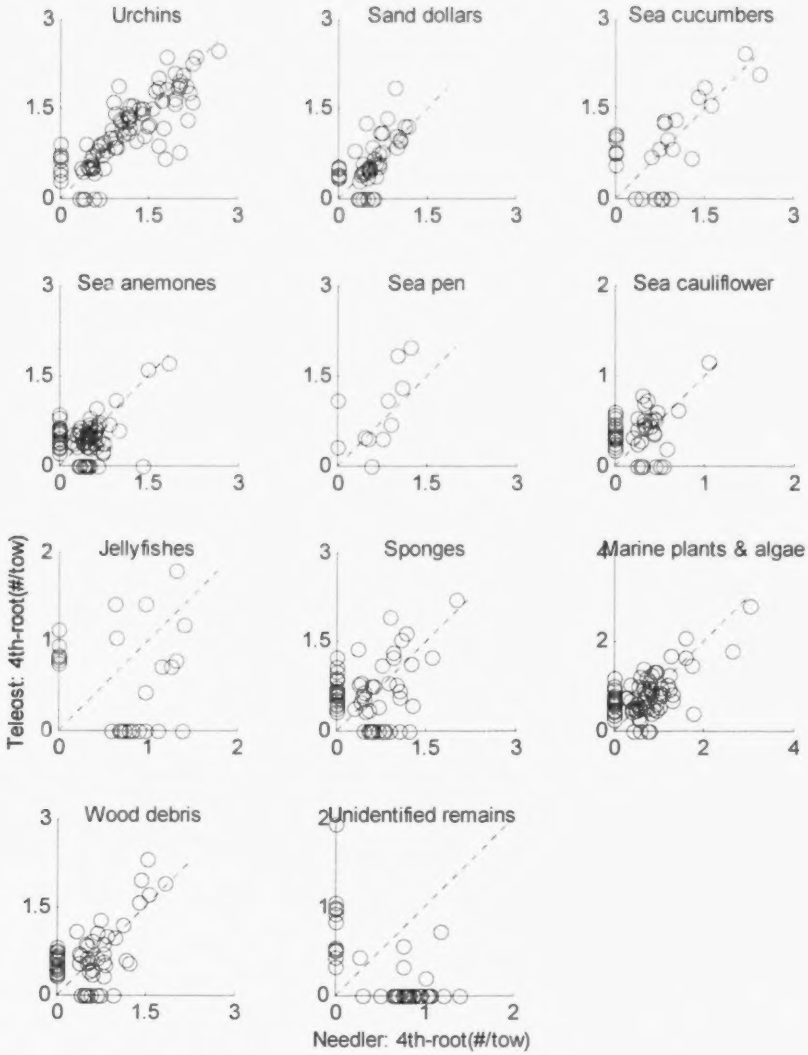

Figure 51. Total standardized catches of various invertebrate species and other biological material from paired sets by the Teleost vs. Alfred Needler from the September experiments.

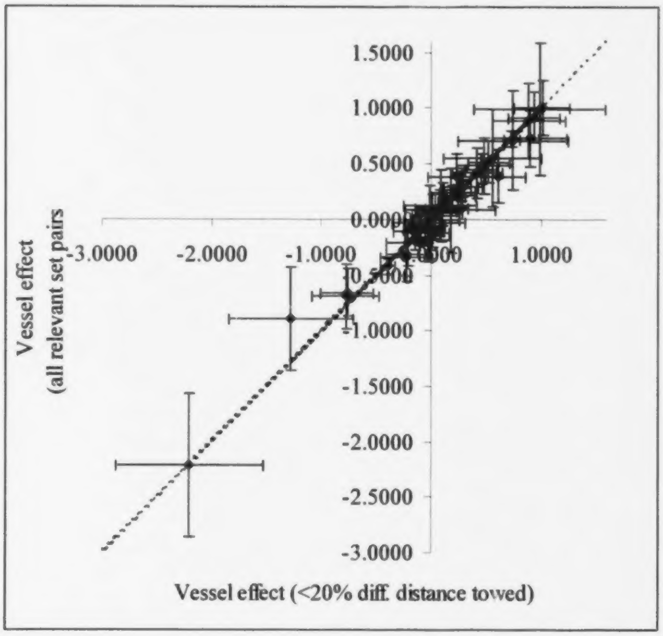

Figure 52. Comparison of fixed-effects analysis results (± SE) when all relevant set pairs are included and excluding sets with a difference in vessel distance towed >20%.

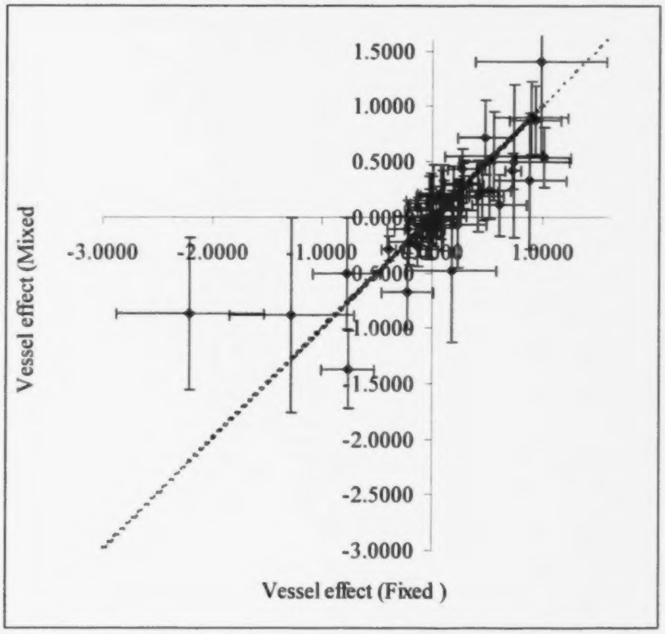

Figure 53. Comparison of fixed-effects and mixed-effects analysis results (±SE; excluding sets with a difference in distance towed between vessels >20%).

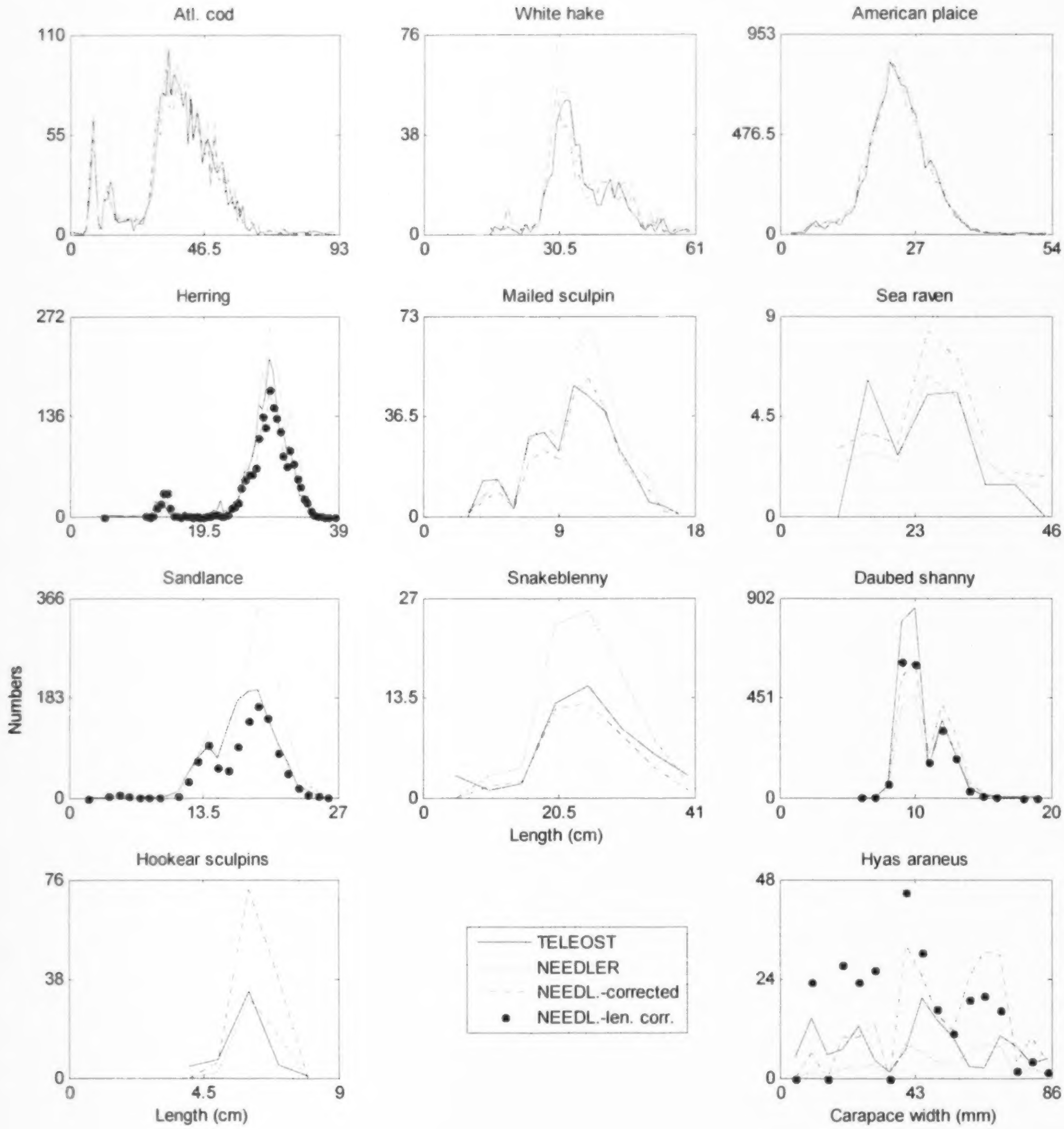

Figure 54. Total standardized catches-at-length by the Teleost, Alfred Needler (uncorrected), Alfred Needler corrected by β_v and Alfred Needler corrected by β_l for those fishes for which a significant difference in catchability between vessels was found. Data from outlier sets (see Appendix II) have been removed.

Appendix I. Numerical codes, taxonomic names and common names of taxa covered by the 2004-2005 comparative fishing experiment analyses.

code	Species name	Common name
10	*Gadus morhua*	Atlantic Cod
12	*Urophycis tenuis*	White hake
23	*Sebastes* sp.	Redfish
30	*Hippoglossus hippoglossus*	Atlantic halibut
31	*Reinhardtius hippoglossoides*	Greenland halibut
40	*Hippoglossoides platessoides*	American plaice
41	*Glyptocephalus cynoglossus*	Witch flounder
42	*Limanda ferruginea*	Yellowtail flounder
43	*Pseudopleuronectes americanus*	Winter flounder
50	*Anarhichas lupus*	Striped Atlantic wolffish
60	*Clupea harengus*	Atlantic Herring
62	*Alosa pseudoharengus*	Gaspereau
64	*Mallotus villosus*	Capelin
70	*Scomber scombrus*	Atlantic Mackerel
112	*Phycis chesteri*	Long fin hake
114	*Enchelyopus cimbrius*	Fourbeard rockling
118	*Gadus ogac*	Greenland cod
201	*Amblyraja radiata*	Thorny skate
202	*Malacoraja senta*	Smooth skate
204	*Leucoraja ocellata*	Winter skate
220	*Squalus acanthias*	Spiny dogfish
241	*Myxine glutinosa*	Atlantic hagfish
300	*Myoxocephalus octodecemspinosus*	Longhorn sculpin
301	*Myoxocephalus scorpius*	Shorthorn sculpin
302	*Gymnocanthus tricuspis*	Arctic staghorn sculpin
304	*Triglops murrayi*	Moustache (mailed) sculpin
306	*Artediellus uncinatus*	Arctic hookear sculpin
314	*Icelus spatula*	Spatulate sculpin
320	*Hemitripterus americanus*	Sea raven
340	*Aspidophoroides monopterygius*	Alligatorfish
341	*Uleina olrikii*	Arctic alligatorfish
350	*Leptagonus decagonus*	Atlantic sea poacher
361	*Gasterosteus aculeatus aculeatus*	Threespine stickleback
400	*Lophius americanus*	Monkfish,goosefish,angler
410	*Nezumia bairdii*	Marlin-spike grenadier
501	*Cyclopterus lumpus*	Lumpfish
502	*Eumicrotremus spinosus*	Atlantic spiny lumpsucker
512	*Liparis gibbus*	Dusky seasnail,
610	*Ammodytes dubius*	Northern sand lance
616	*Gymnelis viridis*	Fish doctor
620	*Lycodes lavalaei*	Laval's eelpout
622	*Lumpenus lumpretaeformis*	Snakeblenny
623	*Leptoclinus maculatus*	Daubed shanny
626	*Eumesogrammus praecisus*	Fourline snake blenny
632	*Lumpenus medius*	Stout eelblenny

code	Species name	Common name
640	*Zoarces americanus*	Ocean pout
646	*Melanostigma atlanticum*	Atlantic soft pout
647	*Lycodes vahlii*	Checker eelpout (Vahl's)
712	*Notolepis rissoi kroyeri*	White barracudina
880	*Artediellus atlanticus*	Atlantic Hookear sculpin
1510	*Buccinidae eggs*	Whelk eggs
1823	*Boltenia* sp.	Sea potato
2100	Decapoda Order	Shrimps
2513	*Cancer irroratus*	Atlantic rock crab
2521	*Hyas coarctatus*	Lyre crab
2523	*Lithodes maja*	Northern stone crab
2526	*Chionoecetes opilio*	Snow crab
2527	*Hyas araneus*	Toad crab
2560	Paguroidea	Hermit crabs
3100	Polychaeta	Bristle worms
3212	*Aphrodita* sp.	Sea mouse
4000	Mollusca	Mollusc shells
4210	*Buccinum* sp.	Whelks
4322	*Chlamys islandicus*	Iceland scallop
4511	*Illex illecebrosus*	Short-fin squid
4521	Octopoda	Octopus
6100	Asteroidea	Starfish
6115	*Ctenodiscus crispatus*	Mud star
6120	*Solaster* sp.	Sunstars
6200	Ophiuroidea	Brittle stars
6300	Gorgonocephalidae, Asteronychidae	Basket stars
6400	*Strongylocentrotus* sp.	Sea urchins
6500	Clypeasteroida	Sand dollars
6600	Holothuroidea	Sea cucumbers
8300	Anthozoa	Sea anemone
8318	*Pennatula borealis*	Sea pen
8324	*Gersemia rubiformis*	Sea cauliflower
8500	Scyphozoa	Jellyfishes
8600	Porifera	Sponges
9300	Thallophyta	Marine plants & algae

Appendix II. Sets that were identified as outliers or as having considerable leverage in the analyses without and with covariates. Catches are standardized to a 1.75 nautical mile tow and are in numbers for fish, large crabs and squid, and in kg for the other taxa.

analysis	code	Species	survey	year	Set	Needler catch	Teleost catch
length-aggregated	10	Cod	2	2005	44	14.0	216.8
length-aggregated	10	Cod	1	2005	59	345.6	776.7
length-aggregated	10	Cod	2	2005	83	130.5	328.5
length-aggregated	23	Redfish	2	2005	27	274.0	30.3
length-aggregated	23	Redfish	2	2005	35	249.0	20.6
length-aggregated	23	Redfish	2	2005	36	22.0	243.5
length-aggregated	23	Redfish	2	2005	1033	32.0	265.4
length-aggregated	23	Redfish	2	2005	1034	109.0	338.7
length-aggregated	23	Redfish	2	2005	1036	284.0	404.6
length-aggregated	23	Redfish	2	2005	1051	33.8	278.2
length-aggregated	23	Redfish	2	2005	1056	252.0	0.0
length-aggregated	23	Redfish	2	2005	1069	272.2	307.5
length-aggregated	40	American plaice	2	2005	36	49.0	229.8
length-aggregated	41	witch flounder	1	2005	39	104.0	8.2
length-aggregated	43	winter flounder	1	2005	32	243.6	193.9
length-aggregated	43	winter flounder	1	2005	96	105.3	233.3
length-aggregated	60	herring	1	2005	36	265.5	30.3
length-aggregated	60	herring	1	2005	56	202.6	197.4
length-aggregated	60	herring	1	2005	57	195.4	1.1
length-aggregated	60	herring	1	2005	78	404.2	382.1
length-aggregated	60	herring	1	2005	81	5.6	374.8
length-aggregated	60	herring	1	2005	112	179.0	200.3
length-aggregated	64	capelin	2	2005	14	293.0	166.9
length-aggregated	64	capelin	2	2005	16	51.0	131.5
length-aggregated	64	capelin	2	2005	17	148.0	107.5
length-aggregated	64	capelin	2	2005	24	62.3	222.0
length-aggregated	301	shorthorn sculpin	1	2005	32	15.9	0.0
length-aggregated	302	arctic staghorn sculpin	1	2005	109	39.7	75.1
length-aggregated	320	sea raven	2	2005	44	4.0	42.8
length-aggregated	320	sea raven	2	2005	1040	37.0	3.0
length-aggregated	610	sand lance	2	2005	36	205.0	0.0
length-aggregated	610	sand lance	2	2005	37	177.0	114.0
length-aggregated	610	sand lance	2	2005	43	200.0	0.0
length-aggregated	610	sand lance	2	2005	67	0.0	52.0
length-aggregated	610	sand lance	2	2005	69	130.0	82.4
length-aggregated	610	sand lance	2	2005	76	126.4	91.1
length-aggregated	647	Vahl's eelpout	1	2005	39	59.7	2.0
length-aggregated	2521	Lyre crabs	2	2005	12	0.0	70.2
length-aggregated	2521	Lyre crabs	2	2005	16	0.0	50.6
length-aggregated	2521	Lyre crabs	1	2004	90	58.3	0.0
length-aggregated	2526	snow crab	1	2004	86	220.3	78.4
length-aggregated	2526	snow crab	1	2005	89	255.7	115.7

analysis	code	Species	survey	year	Set	Needler catch	Teleost catch
length-aggregated	4511	short-fin squid	2	2005	1005	78.0	73.7
length-aggregated	1510	Whelk eggs	1	2004	91	3.76	0.01
length-aggregated	1823	Sea potato	1	2005	38	52.2	0
length-aggregated	1823	Sea potato	1	2005	49	1.7	6.4
length-aggregated	2100	Shrimps	1	2005	101	93	22.8
length-aggregated	2100	Shrimps	1	2005	108	8.9	30.1
length-aggregated	2526	Snow crab	2	2005	17	8	288.6
length-aggregated	3100	Bristle worms	1	2005	100	0.0153	0
length-aggregated	3100	Bristle worms	1	2005	114	0.015	0.001
length-aggregated	4000	Mollusc shells	1	2005	86	3	0.7
length-aggregated	4210	Whelks	1	2004	91	1.3	0.2
length-aggregated	4322	Iceland scallop	1	2005	68	0.3	0
length-aggregated	6100	Starfish	1	2005	41	7.1	0
length-aggregated	6100	Starfish	1	2005	49	0.3	2
length-aggregated	6100	Starfish	1	2005	78	0	2.3
length-aggregated	6200	Brittle star	1	2005	42	0	5.5
length-aggregated	6500	Sand dollars	1	2005	68	0.8	11.9
length-aggregated	6600	Sea cucumbers	1	2005	96	35.3	19.2
length-aggregated	8300	Sea anemone	1	2005	109	4.1	0
length-dependent	10	Cod	1	2005	59	345.6	776.7
length-dependent	23	Redfish	2	2005	1056	252.0	0.0
length-dependent	23	Redfish	2	2005	1069	272.2	307.5
length-dependent	40	American plaice	2	2005	36	49.0	229.8
length-dependent	41	witch flounder	1	2005	39	104.0	8.2
length-dependent	41	witch flounder	1	2005	154	46.7	120.6
length-dependent	42	yellowtail flounder	2	2005	40	66.1	13.0
length-dependent	42	yellowtail flounder	1	2005	59	422.1	335.2
length-dependent	42	yellowtail flounder	1	2005	60	406.0	290.8
length-dependent	42	yellowtail flounder	2	2005	60	109.0	186.4
length-dependent	43	winter flounder	1	2005	31	137.1	18.6
length-dependent	43	winter flounder	1	2005	32	243.6	193.9
length-dependent	43	winter flounder	1	2005	96	105.3	233.3
length-dependent	60	herring	1	2005	36	265.5	30.3
length-dependent	60	herring	1	2005	56	202.6	197.4
length-dependent	60	herring	1	2005	57	195.4	1.1
length-dependent	60	herring	1	2005	78	404.2	382.1
length-dependent	60	herring	1	2005	81	5.6	374.8
length-dependent	64	capelin	2	2005	14	293.0	166.9
length-dependent	64	capelin	2	2005	24	62.3	222.0
length-dependent	114	fourbeard rockling	1	2005	108	15.2	29.2
length-dependent	202	smooth skate	2	2005	22	9.0	1.0
length-dependent	202	smooth skate	2	2005	84	12.5	3.1
length-dependent	300	longhorn sculpin	1	2005	32	37.8	4.0
length-dependent	300	longhorn sculpin	1	2005	96	8.9	18.6
length-dependent	301	shorthorn sculpin	1	2005	32	15.9	0.0
length-dependent	320	sea raven	2	2005	44	4.0	42.8
length-dependent	320	sea raven	2	2005	1040	37.0	3.0
length-dependent	620	Laval's eelpout	1	2005	85	25.6	1.3

analysis	code	Species	survey	year	Set	Needler catch	Teleos t catch
length-dependent	640	Ocean pout	2	2005	1044	2.0	19.9
length-dependent	647	Vahl's eelpout	1	2005	39	59.7	2.0
length-dependent	647	Vahl's eelpout	1	2005	154	8.8	17.8
length-dependent	2521	Lyre crab	1	2004	90	58.3	0.0
length-dependent	2527	Toad crab	1	2005	38	13.0	4.1
depth-dependent	10	Cod	2	2005	83	130.5	328.5
depth-dependent	23	Redfish	2	2005	1056	252.0	0.0
depth-dependent	23	Redfish	2	2005	1069	272.2	307.5
depth-dependent	41	witch flounder	1	2005	39	104.0	8.2
depth-dependent	43	winter flounder	1	2005	32	243.6	193.9
depth-dependent	43	winter flounder	1	2005	96	105.3	233.3
depth-dependent	60	herring	1	2005	36	265.5	30.3
depth-dependent	60	herring	1	2005	56	202.6	197.4
depth-dependent	60	herring	1	2005	78	404.2	382.1
depth-dependent	60	herring	1	2005	81	5.6	374.8
depth-dependent	62	gaspereau	1	2005	31	1.9	108.5
depth-dependent	64	capelin	2	2005	14	293.0	166.9
depth-dependent	64	capelin	2	2005	16	51.0	131.5
depth-dependent	64	capelin	2	2005	24	62.3	222.0
depth-dependent	2521	Lyre crab	2	2005	12	0.0	70.2
depth-dependent	2521	Lyre crab	2	2005	16	0.0	50.6
depth-dependent	2521	Lyre crab	1	2004	90	58.3	0.0
depth-dependent	2526	snow crab	2	2005	17	8.0	288.6
depth-dependent	2527	Toad crab	2	2005	12	69.0	0.0

Appendix III. Proportion of total catch in each of the September and July comparative fishing experiments that was occurred in set pairs where the difference in tow distance between vessels was ≥20%. Note that such a difference occurred in seven of 101 (7%) sets in September and four of 173 (~2%) sets in July.

code	*species*	*Proportion September*	*Proportion July*
10	COD(ATLANTIC)	0.062	0.062
12	WHITE HAKE	0.000	0.467
23	REDFISH UNSEPARATED	0.001	0.024
30	HALIBUT(ATLANTIC)	0.000	0.000
31	TURBOT,GREENLAND HALIBUT	0.001	0.112
40	AMERICAN PLAICE	0.086	0.019
41	WITCH FLOUNDER	0.000	0.020
42	YELLOWTAIL FLOUNDER	0.080	0.001
43	WINTER FLOUNDER	0.004	0.226
50	STRIPED ATL WOLFFISH	0.000	0.018
60	HERRING(ATLANTIC)	0.003	0.004
62	ALEWIFE	0.000	0.004
63	RAINBOW SMELT	0.000	
64	CAPELIN	0.025	0.020
70	MACKEREL(ATLANTIC)	0.115	0.045
110	ARCTIC COD	0.000	
112	LONGFIN HAKE	0.000	0.005
114	FOURBEARD ROCKLING	0.008	0.081
118	GREENLAND COD	0.314	
122	CUNNER	0.000	0.000
143	BRILL/WINDOWPANE	0.000	0.000
201	THORNY SKATE	0.000	0.006
202	SMOOTH SKATE	0.000	0.030
204	WINTER SKATE	0.000	0.000
241	ATLANTIC HAGFISH	0.000	0.010
300	LONGHORN SCULPIN	0.018	0.040
301	SHORTHORN SCULPIN	0.017	0.000
302	ARCTIC STAGHORN SCULPIN	0.135	
304	MOUSTACHE (MAILED) SCULPIN	0.086	0.004
306	ARCTIC HOOKEAR SCULPIN	0.085	0.000
313	TWOHORN SCULPIN	0.000	
314	SPATULATE SCULPIN	0.056	0.000
320	SEA RAVEN	0.021	0.029
340	ALLIGATORFISH	0.144	0.008
341	ARCTIC ALLIGATORFISH	0.031	
350	ATL SEA POACHER	0.003	0.025
361	THREESPINE STICKLEBACK	0.000	
410	MARLIN-SPIKE GRENADIER	0.000	0.202
502	ATL SPINY LUMPSUCKER	0.070	0.023
505	SEASNAIL,GELATINOUS	0.000	
512	SEASNAIL,DUSKY	0.062	0.000

code	species	Proportion September	Proportion July
610	NORTHERN SAND LANCE	0.008	0.000
616	FISH DOCTOR	0.070	0.000
620	LAVAL`S EELPOUT	0.168	0.000
622	SNAKEBLENNY	0.000	0.019
623	DAUBED SHANNY	0.028	0.032
626	4-LINE SNAKE BLENNY	0.382	
630	WRYMOUTH	0.000	
632	STOUT EELBLENNY	0.004	
640	OCEAN POUT(COMMON)	0.000	0.062
647	CHECKER EELPOUT(VAHL)	0.000	0.051
712	WHITE BARRACUDINA	0.000	0.000
880	HOOKEAR SCULPIN,ATL.	0.085	0.012
2513	ATL ROCK CRAB	0.004	0.027
2521	HYAS COARCTATUS	0.208	0.002
2523	NORTHERN STONE CRAB	0.000	0.077
2526	SNOW CRAB (QUEEN)	0.078	0.050
2527	TOAD CRAB	0.130	0.041
2550	AMERICAN LOBSTER	0.001	
4511	SHORT-FIN SQUID	0.018	0.011